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North Revilla Final Environmental Impact Statement

Ketchikan Pulp Company Long-Term Timber Sale Contract

Volume I

ACRONYMS AND SYMBOLS

ADF&G	Alaska Department of Fish and Game
AHMU	Aquatic Habitat Management Unit
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ASQ	Allowable Sale Quantity
BBF	One billion board feet
BMP	Best Management Practice
CEQ	Council on Environmental Quality
CFL	Commercial Forest Land
CFR	Code of Federal Regulations
CZMA	Coastal Zone Management Act of 1976
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EVC	Existing/Expected Visual Condition
FEIS	Final Environmental Impact Statement
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
IDT	Interdisciplinary Team
KPC	Ketchikan Pulp Company
KV	Knutsen-Vandenberg Act
LTF	Log Transfer Facility
LUD	Land Use Designation
LWD	Large Woody Debris (same as LOD)
MBF	One thousand board feet
MELP	Multi-Entry Layout Process
MIS	Management Indicator Species
MM	Maximum Modification
MMBF	One million board feet
NEPA	National Environmental Policy Act
NFMA	National Forest Management Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
P	Primitive
PR	Partial retention
R	Retention
RM	Roaded modified
RN	Roaded natural
ROD	Record of decision
ROS	Recreation Opportunity Spectrum
SHPO	State Historic Preservation Officer
SPM	Semi-primitive motorized
SPNM	Semi-primitive nonmotorized
TLMP	Tongass Land Management Plan
TRUCS	Tongass Resource Use Cooperative Survey
TTRA	Tongass Timber Reform Act
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	United States Fish and Wildlife Service
VCU	Value Comparison Unit
VQO	Visual Quality Objective
WAA	Wildlife Analysis Area

Acknowledgements
Front cover: By Cindy Ross Barber, 1992. The design illustrates the range of interconnected issues addressed in the EIS.

Final Environmental Impact Statement

North Revilla

United States Department of Agriculture
Forest Service—Alaska Region
Alaska

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Abstract

The USDA Forest Service proposes to harvest approximately 200 million board feet (MMBF) of timber in the North Revilla Project Area, Ketchikan Ranger District, Ketchikan Administrative Area, Tongass National Forest. Timber volume would be offered to the Ketchikan Pulp Company (KPC) under the KPC Long-term Timber Sale Contract (A10fs-1042), in a series of separate offerings ranging in size from 10 to 50 MMBF. The actions analyzed in this EIS are designed to implement direction contained in the Tongass Land Management Plan (TLMP, 1979a, as amended) and the Tongass Timber Reform Act. The EIS describes six alternatives which provide different combinations of resource outputs and spatial locations of harvest units. The alternatives include: 1) No Action, proposing no new harvest from the Project Area for the KPC Long-term Sale Contract at this time; 2) configure harvest units to provide the maximum amount of timber within Forest Plan standards and guidelines; 3) configure harvest units to emphasize timber sale economics and conventional cable yarding methods; 4) configure harvest units to emphasize wildlife habitat and maintain the integrity of large unfragmented blocks of old-growth forest; 5) configure harvest units to emphasize recreation and scenic quality; and 6) configure harvest units to emphasize a positive net economic return, while seeking to protect key recreation areas and reduce the harvest of high value wildlife habitat.

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Chapter 1

Purpose and Need

Key Terms

Allowable Sale Quantity (ASQ) - the maximum quantity of timber that may be sold each decade from a national forest

Land Use Designation (LUD) - method of classifying land uses, allocated by the Forest Plan

Long-Term Contract - Long-term Timber Sale Contract with Ketchikan Pulp Company; most recent EIS for this contract is referred to here as "1989-94 LTS EIS".

Management Area - an area for which management direction was written in the Forest Plan (TLMP 1979a, as amended 1986) management areas encompass one or more VCU's

Offering - a Forest Service specification of timber harvest units, subdivisions, roads, and other facilities and operations to meet the requirements of a contract

Old-growth Forest - a forest stand characterized by trees usually well past the age of maturity, with declining growth rates, dead and dying trees, snags, and downed woody material

Primary Sale Area - the KPC Long-term Sale Contract is comprised of Allotments E, F, and G and other areas within these allotments; the Project Area is within Allotment F

Record of Decision (ROD) - a document, based on information disclosed in the Final EIS, which identifies the alternative chosen, mitigation and monitoring measures to be implemented, and other information relative to the decision. The North Revilla ROD will be issued by the Ketchikan Area Forest Supervisor.

Scoping Process - activities used to determine the scope and significance of a proposed action, what level of analysis is required, what data is needed, and what level of public participation is appropriate

Tongass Land Management Plan (TLMP) - the 10-year land allocation plan for the Tongass National Forest—TLMP was completed in 1979 and was amended in 1986 and again 1991 (TLMP 1979a, as amended). TLMP is currently undergoing revision; a Supplement to the Revision Draft Environmental Impact Statement was issued in 1991. Until the Revision is completed, the TLMP as amended remains in effect (TLMP Draft Revision 1991a).

Value Comparison Unit (VCU) - areas which generally encompass a drainage basin to provide a common set of areas where resource inventories could be conducted and resource interpretations made

1 Purpose and Need

Introduction

This Final Environmental Impact Statement (Final EIS or FEIS) discloses direct, indirect, and cumulative environmental effects and alternative actions that meet provisions of the Long-Term Timber Sale Contract in the North Revilla Project Area of the Ketchikan Administrative Area, Tongass National Forest. This chapter specifies the underlying purpose and need to which the Forest Service is responding, in proposing alternatives in this Environmental Impact Statement (EIS).

Approximately 200 million board feet (MMBF) of timber is needed to help meet the three-year Current Timber Supply requirement of the Long-Term Timber Sale Contract (Long-Term Contract) between the Forest Service and the Ketchikan Pulp Company (KPC); see Appendix A, Reasons for Scheduling. Timber volume would be offered to KPC in separate timber offerings ranging in size from 10 to 50 MMBF. KPC may elect to reject an Offering and the Forest Service may sell a rejected Offering as part of the independent timber sale program (KPC contract BO.63).

Project Area

The 109,520-acre North Revilla Project Area is located approximately 30 air miles north of Ketchikan, Alaska. It encompasses an area of northwest Revillagigedo (Revilla) Island, along Behm Canal and from Indian Point on the southwest end to Beaver Creek on the northeast end. It includes the drainages associated with Gedney Pass, Neets Bay, and Traitors Cove. The focus for this project will be the area designated as the Primary Sale Area, Allotment F, for the Long-Term Contract. The background to the Long-Term Contract is discussed later in this chapter.

The Project Area is entirely within the TLMP (1979a, as amended) Management Area K32, which is subdivided into eight Value Comparison Units (VCU's) whose boundaries generally follow watershed divides with a few minor exceptions. This management area includes VCU's: 732, 733, 735, 736, 737, 738, 739, and 740.

Figure 1-1 displays the Project Area and its geographical relationship to the Ketchikan Area. Figure 1-2 displays the VCU's.

Proposed Action

The Tongass National Forest, Ketchikan Area proposes to harvest approximately 200 MMBF of timber from an estimated 6,600 acres through a series of offerings beginning in 1994. Approximately 35 miles of existing road would be reconstructed and 100 miles of new road would be built to facilitate timber removal. Seven Log Transfer Facilities (LTF's) would be constructed or reconstructed to implement the proposed action.

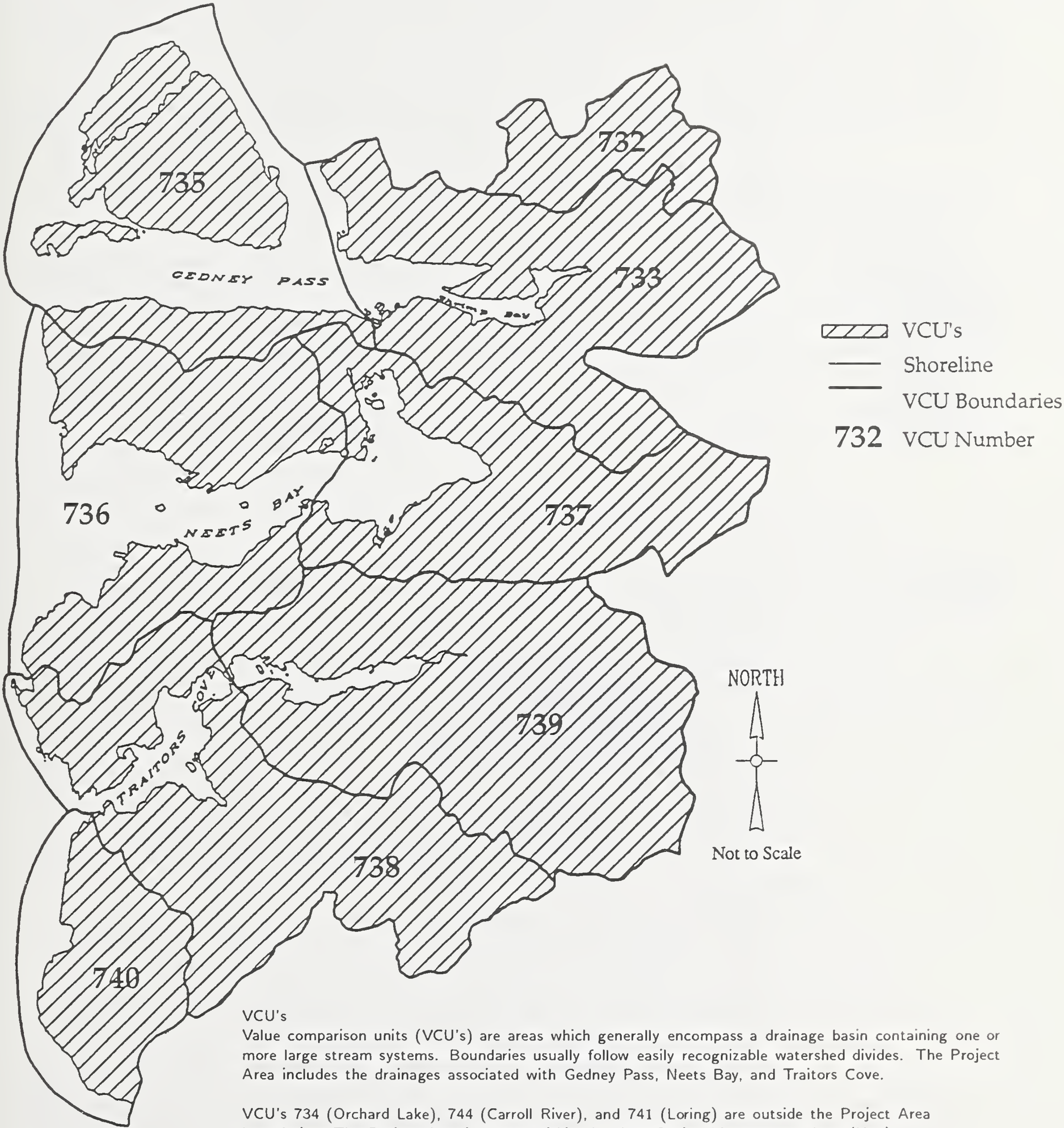
The proposed action will also implement the Forest Plan known as the Tongass Land Management Plan (TLMP 1979a, as amended), thereby moving from the existing forest condition toward the desired future condition. The alternatives and actions considered in this analysis are possible approaches toward the desired future condition.

1 Purpose and Need

Figure 1-1
North Revilla Project Area Vicinity Map

The 109,520-acre Project Area is located approximately 30 miles north of the Ketchikan. It encompasses an area northwest of Revillagigedo (Revilla) Island, from Indian Point on the southwest end to Beaver Creek on the northeast end, along the Behm Canal.

Figure 1-2
North Revilla Project Area Value Comparison Units (VCU's)



VCU's

Value comparison units (VCU's) are areas which generally encompass a drainage basin containing one or more large stream systems. Boundaries usually follow easily recognizable watershed divides. The Project Area includes the drainages associated with Gedney Pass, Neets Bay, and Traitors Cove.

VCU's 734 (Orchard Lake), 744 (Carroll River), and 741 (Loring) are outside the Project Area boundaries. The Project Area is totally within the West Revilla Management Area (K32).

Purpose of and Need for Action

The purpose of the proposed action is to help meet the remaining 2.5 BBF commitment to the Long-Term Contract by providing for the harvest of approximately 200 MMBF of timber in an environmentally sound and economic manner. The proposed action is intended to help satisfy the three-year Current Timber Supply requirement of the Long-term Contract in accordance with direction found in the Forest Plan.

For this project the volume has been determined to be approximately 200 MMBF, a volume that reflects a management decision based on the current schedule to provide a three-year timber supply of 615 MMBF for the KPC Long-Term Contract. (See Appendix A.) There is also a need to help contribute towards the obligation set by Congress under the Tongass Timber Reform Act (TTRA), (Sec. 101) of 1990, directing the Forest Service "to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, seek to provide a supply of timber from the Tongass National Forest which meets annual market demand..."

The alternatives and actions considered in this analysis are possible approaches to meeting this purpose and need.

Contract Obligations

The Long-term Contract with KPC was originally signed in 1951 and was most recently modified in February 1991 (see Background to Long-term Contract later in this chapter). Under the terms of the modified contract, the Forest Service is required to "develop a tentative Offering schedule based upon the Tongass National Forest Land and Resource Management Plan, which shall display Offering Areas and timber volumes proposed for harvest.... The tentative schedule shall list sufficient timber volume and schedule commencement of the NEPA process by Offering Area or Areas to provide [KPC] a Current Timber Supply sufficient for at least three years of operations hereunder or until the contract termination date, whichever occurs first...." Further, the Forest Service is required to "seek to specify sufficient Offerings to maintain a Current Timber Supply in all Offering Areas that totals at least three years of operations hereunder or until the contract termination date, whichever occurs first, and which meets the production requirements of [KPC's] manufacturing facilities." (KPC, Contract No. A10fs-1042, 7/26/51, as amended 2/26/91)

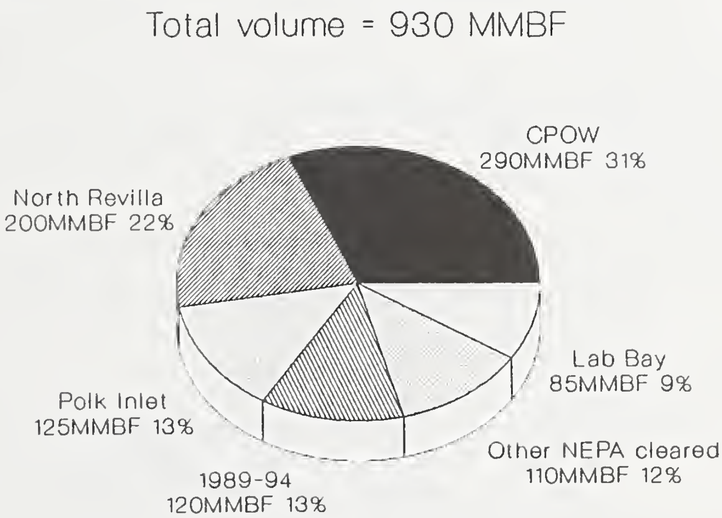
The total timber harvest originally called for under the Long-Term Contract is 8.25 billion board feet. Analysis indicates that KPC needs to harvest 205 MMBF per year to complete the contract. Four timber projects—CPOW, Lab Bay, Polk, and Revilla—were initiated for the KPC Long-Term Contract within the Primary Sale Area (PSA), as directed by the contract to seek to find timber supplies within the PSA before seeking volume within contingency areas (see Figure 1-7). There is expected to be 120 MMBF of timber volume remaining from previous NEPA projects which will be available to KPC by the time the Final EIS is released. Therefore, these four timber projects need to produce a total of 700 MMBF, which, when combined with the 120 MMBF currently available, will provide volume for the 1993 logging season, plus a three-year timber supply, as required by TTRA.

This 700 MMBF was divided among the four timber projects based on the size of the project areas, as well as on their relative abilities to produce timber volume expeditiously. Other factors considered in making this volume determination for the project included: (1) this harvest level is consistent with the sale schedule in the TLMP (1979a, as amended); (2) sufficient volume has been determined to be available in the Project Area; (3) there are existing developments including a road network and some LTF's in place; (4) there is minimal subsistence use when compared to other suitable areas; and (5) the current Forest Plan (TLMP 1979a, as amended) calls for harvest in this Project Area.

Once these four projects were underway, delays were experienced in their completion. These delays were such that only limited volume could be made available from them for the 1993 logging season. This also had an effect of delaying the time when a three-year timber supply could be achieved. In an effort to provide enough volume for the 1993 logging season, and to stay on schedule for attaining a three-year timber supply, four independent sales were released to KPC. These sales total 107 MMBF and include: 12-Mile (12 MMBF), Frosty (33 MMBF), Shelter Cove (17 MMBF), and Starfish (45 MMBF). Frosty and Starfish are located on the Wrangell District of the Stikine Area.

Figure 1-3 illustrates the current and projected timber supply for the long-term contract with KPC.

Figure 1-3
Contribution of Projects to Contract Requirements



See "How the North Revilla Project Area was Selected", later in this chapter, for further background of the KPC contract.

Existing and Desired Future Condition

The existing condition of the Project Area is described in Chapter Three of this EIS, in the "Affected Environment" portion of each resource section. The Neets Bay, Traitors Cove, and Margaret Bay valley bottoms along with the Gedney Pass shoreline, were extensively logged from the 1950's through the 1970's. A moderate amount of timber harvest occurred in the 1980's through portions of the Project Area.

Tongass Land Management Plan (TLMP)

TLMP, as amended
The original TLMP of 1979 was amended in 1986 and 1991. TLMP, as amended, is the Forest Plan in effect until a revised Plan is in place. This EIS references TLMP and its amendments as: TLMP (1979a, as amended).

TLMP Revision
As required by NFMA, TLMP is undergoing revision. The TLMP Revision Draft EIS was completed in 1990. A Supplement to the Revision was necessitated by TTRA and was completed in 1991. This EIS references all the TLMP revisions, as: TLMP Draft Revision (1991a).

This EIS tiers to TLMP, as amended. It also proposes management consistent with the TLMP Supplement Draft EIS, Proposed Revised Forest Plan, Alt. P, standards and guidelines.

The majority of the second growth is fully stocked, 20-30 years old and 20-40 feet tall. The Project Area contains 74,541 acres of commercial forest land, of which 56,927 acres of old-growth remain. Recreation use within the Project Area focuses on water related activities. Land based subsistence use has been low.

The desired future condition, as specified in the Management Direction/Emphasis for each management area, was established through the Forest planning process and is presented in the TLMP, (1979a, as amended). This management direction contained goals for timber, recreation, visuals, fish, wildlife, and other resources. More than half of the Forest was anticipated to remain in a basically unmodified state over time if current land use designations remained the same. For specific management emphasis and direction for each management area in the North Revilla Project Area, see TLMP as amended in 1985-86 (USDA Forest Service 1986, Doc. 147).

The management emphasis and direction was further refined as the Desired Future Condition in the TLMP Draft Revision (1991a). This desired future condition consists of a mosaic of timber stands of varying sizes and ages, interspersed with areas of old growth and nonforest vegetation, furnishing a sustained yield of timber in balance with other resources and uses.

Achievement of the TLMP Draft Revision desired future condition will require many decades. It will be reached by applying integrated resource management practices that are responsive to site specific, on-the-ground conditions. Roaded access would be provided for suitable timber lands. Harvested old-growth timber will be converted to successive stands of younger trees which will produce higher average volumes per acre than existing stands. Timber including saw logs and utility volume will have contributed to the Forest allowable sale quantity (ASQ).

Riparian areas will be managed to benefit riparian dependent resources. Water quality will continue to meet or exceed state standards. Fish habitat conditions will be maintained or improved. Sensitive visual resources, particularly as viewed from saltwater will be consistent with the proposed visual quality objectives (VQO's).

Recreation opportunities will continue to be associated with float plane and boat access from saltwater. Primitive recreation opportunities will be reduced, but dispersed and developed recreation opportunities associated with roads will be maintained or improved.

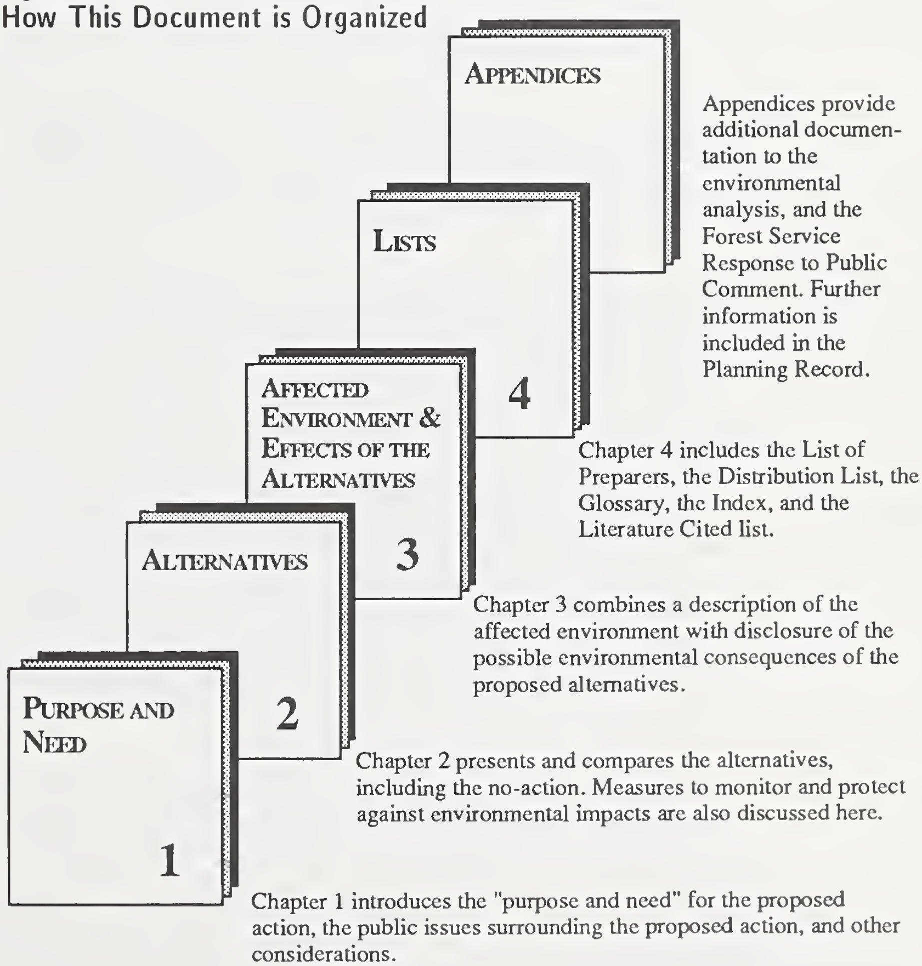
Old-growth stands will be reduced in the Project Area but beach fringe, estuary, and stream protection zones in addition to Orchard Lake and adjacent large blocks of old growth (Misty Fiords National Monument and Naha Roadless Area) will be retained. Old-growth associated species such as hairy woodpecker, marten, Vancouver Canada goose, river otter, and Sitka black-tailed deer will continue to be adequately represented. Management may be adjusted to accommodate any verified use of the area by threatened, endangered, and sensitive species in accordance with recovery habitat maintenance and objectives.

Organization of This Document

This EIS follows the format established in the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508). The environmental, economic, and social consequences of six alternative actions, including the no-action alternative, are disclosed. There are no existing independent timber sale or KPC Long-Term Contract harvest units remaining to be felled or yarded; therefore, a second no-action alternative that would suspend all activities was not brought forward for this project. Analysis of each site-specific alternative discusses: 1) areas considered for harvest and the associated effects upon other resources and activities including fisheries, wildlife, subsistence and recreation opportunities, cultural, hydrology, soils, and scenic quality; 2) the type of logging system to be used; 3) the extent and location of new roads needed for access; and 4) the site location for all Log Transfer Facility (LTF's).

This EIS is divided into four main chapters, as detailed in Figure 1-4. Supporting materials are included in Appendices A through K. The Summary provides a synopsis of chapters 1–3 and is produced as a separate document. Additional documentation may be found in the project Planning Record located at the Forest Supervisor's office in Ketchikan.

Figure 1-4
How This Document is Organized



Decision to be Made and Responsible Official

The EIS is not a decision document but is written to provide sufficient information for the decision-maker. The Council on Environmental Quality (CEQ) Regulations states the EIS "...should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker...." The Forest Supervisor is the deciding officer who must decide whether and when to make timber available for harvest, and how much timber to make available for harvest. The Forest Supervisor can decide to: 1) select one of the alternatives analyzed within the Final EIS; 2) modify an alternative as long as the environmental consequences of that action have been fully analyzed within the Final EIS; or 3) reject all alternatives and request further analysis. If an alternative is selected it will be documented in the Record of Decision (ROD).

Delegation of Authority for Long-term Sale Contract

On June 19, 1992, the USDA Forest Service Region 10 Regional Forester supplemented the original delegation of authority letter for the KPC Contract. As a result of this delegation of authority, the Forest Supervisor is now the responsible official for this Environmental Impact Statement.

Relationship to Other Planning Levels

The North Revilla EIS is part of a hierarchical planning process. The sequence begins with long-range planning at the national level and continues through the regional and Forest levels to the project level. Because this EIS is a project level analysis, its scope is confined to issues within the Project Area; that is, it does not attempt to further analyze decisions made in the following higher level plans.

National Level

The 1990 Program and Assessment as directed by the Forest and Rangeland Renewable Resources Planning Act of 1974 (Resources Planning Act), as amended, provides national direction for resource allocations and targets. An assessment of the forest and rangeland renewable resources is required every ten years, and development of a program for managing those resources is required every five years. The Resources Planning Act program provides Congress with a basis to link annual budgets with long-term resource needs.

Regional Level

The Alaska Regional Guide EIS (1983), addresses regional issues specific to Alaska, establishes management standards and guidelines, and displays resource outputs for the Tongass National Forest.

Forest Level

The National Forest Management Act of 1976 (NFMA) directs each national forest to prepare a land management plan. The Tongass Land Management Plan (TLMP) was completed in 1979 to guide management of the Tongass National Forest. It was amended in 1986 and again in 1991. The TLMP is currently undergoing revision as mandated by the NFMA; a Supplement to the Revision Draft EIS was issued in 1991 (USDA Forest Service 1991a). Until the ROD for the Revision is signed, the TLMP (1979a, as amended) remains in effect.

Project Level

Other Projects

The 1984-89 Long-Term Sale Contract EIS (LTS EIS) was the most recent EIS addressing the KPC Long-Term Contract on the Project Area. It provided 54 MMBF and harvest units throughout the Project Area, and all harvest is complete.

Current Project

The North Revilla EIS presents a range of alternatives, and displays site-specific descriptions and impacts of the proposed activities in Alternatives 1-6.

- This EIS is "tiered" to the TLMP EIS 1979a, as amended in 1986 and 1991 as permitted by 40 CFR 1502.20.
- This EIS also tiers to the Alaska Regional Guide EIS, 1983.

Relevant discussion from the following documents has been incorporated by reference rather than repeated (40 CFR 1502.21):

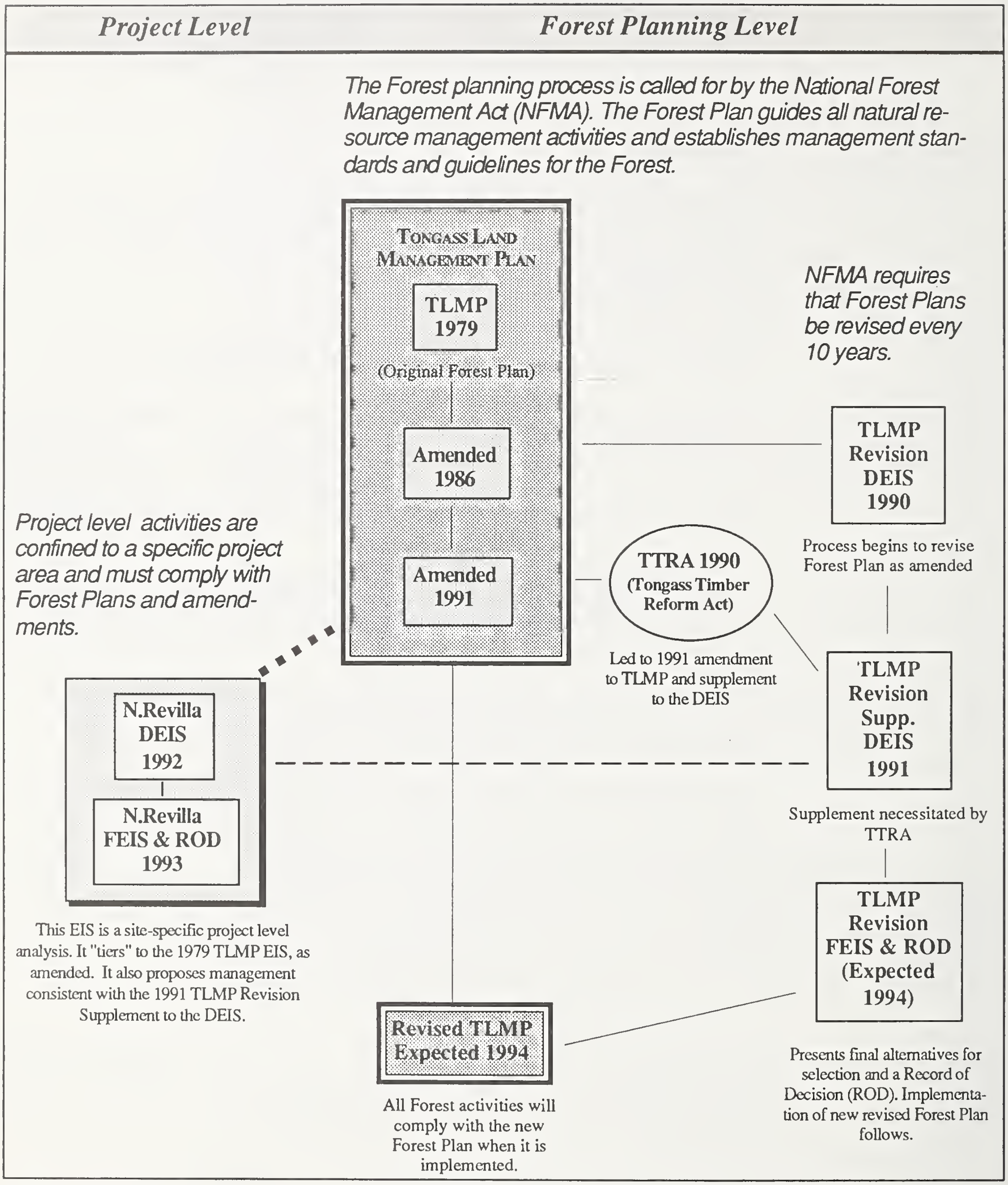
- This EIS proposes management consistent with the TLMP Revision Supplement Draft EIS, Alternative P (USDA Forest Service 1991a). Documented analyses in TLMP or the TLMP Draft Revision will be referenced rather than repeated in some instances in this EIS.

This EIS makes no recommendations for site-specific amendments to the Forest Plan in the form of land allocations to provide old-growth habitat conditions or management for visual quality. Such decisions are made by the Forest Plan.

The Interdisciplinary Team (IDT) used a systematic approach to analyze the proposed project, estimate the environmental effects, and prepare this EIS. The planning process complies with the National Environmental Policy Act (NEPA). Planning was coordinated with affected Federal, State and local agencies.

The TLMP process and its relationship to the North Revilla Project is illustrated in Figure 1-5.

Figure 1-5
Relationship of the TLMP Planning Documents



Land Use Designations

The current TLMP (1979a, as amended) designates areas appropriate for various activities through four Land Use Designation (LUD) allocations. The proposed TLMP Draft Revision (1991a) would provide more specific management direction by subdividing the Project Area into refined LUD's and by applying specific standards and guidelines. This EIS also utilizes the standards and guidelines presented in the TLMP Draft Revision (1991a).

TLMP, as Amended

The North Revilla Project Area is allocated to LUD III and IV areas and described below. Full definitions of all LUD's are presented in the current TLMP (1979a, as amended).

LUD III

Areas allocated to LUD III are to be managed for a variety of uses. The emphasis is on managing for both amenity and commodity oriented uses in a compatible manner to provide the greatest combination of benefits. These areas usually have high amenity values in conjunction with high commodity values. Allowances in calculated potential timber yield have been made to meet multiple-use coordination objectives. Specifics include:

- Potential timber yields will be reduced to the extent needed to protect important biological and aesthetic values;
- Both permanent and temporary roads are allowed;
- Roads are located and designed to retain important recreational and scenic qualities;
- Mineral development is subject to existing laws and regulations;
- Needed trails can be provided;
- A full range of recreational facilities is permissible; and
- A full range of fisheries improvement projects is permitted.

LUD IV

Areas allocated to LUD IV provide opportunities for intensive development of resources. Emphasis is primarily on commodity or market resources and their uses. Amenity values are also considered. When conflicts regarding competing resource use arise, resolution most often would be in favor of commodity values. Allowances in calculated potential timber yield have been made to provide for protection of physical and biological productivity. Specifics include:

- Timber is to be harvested primarily by clearcutting;
- Potential timber yields are to be reduced only to the extent necessary to protect the biological and aesthetic values;
- Mineral development is subject to existing laws and regulations;
- Permanent or temporary roads may be built;
- Motorized use is permitted;
- A full range of recreational facilities is permitted;

- A full range of fisheries improvement projects is permitted; and
- Needed trails can be provided.

Table 1-1 displays the Management Areas, VCU's and the corresponding acres associated with each Land Use Designations. Figures 1-6 and 1-7 illustrate the land allocations as defined in the TLMP, as amended (1979a) and the TLMP Draft Revision (1991a).

Table 1-1
Land Use Designations as defined in TLMP (1979a, as amended)

		TLMP, Amended Land Use Designations		
Management Area	VCU	LUD III	LUD IV	Total Acres
K32	732	4,790	0	4,790
K32	733	17,710	0	17,710
K32	735	10,090	0	10,090
K32	736	0	13,060	13,060
K32	737	0	13,820	13,060
K32	738	0	18,270	18,270
K32	739	25,330	0	25,330
K32	740	6,450	0	6,450
Total Acres Excluding Saltwater		6,450	45,150	109,520

LUD III — emphasis on both amenity and commodity oriented uses
LUD IV — emphasis primarily on commodity market resources
(See TLMP as amended for a complete description of each Land Use Designation)
Note: Discrepancies may be found between tables due to rounding.

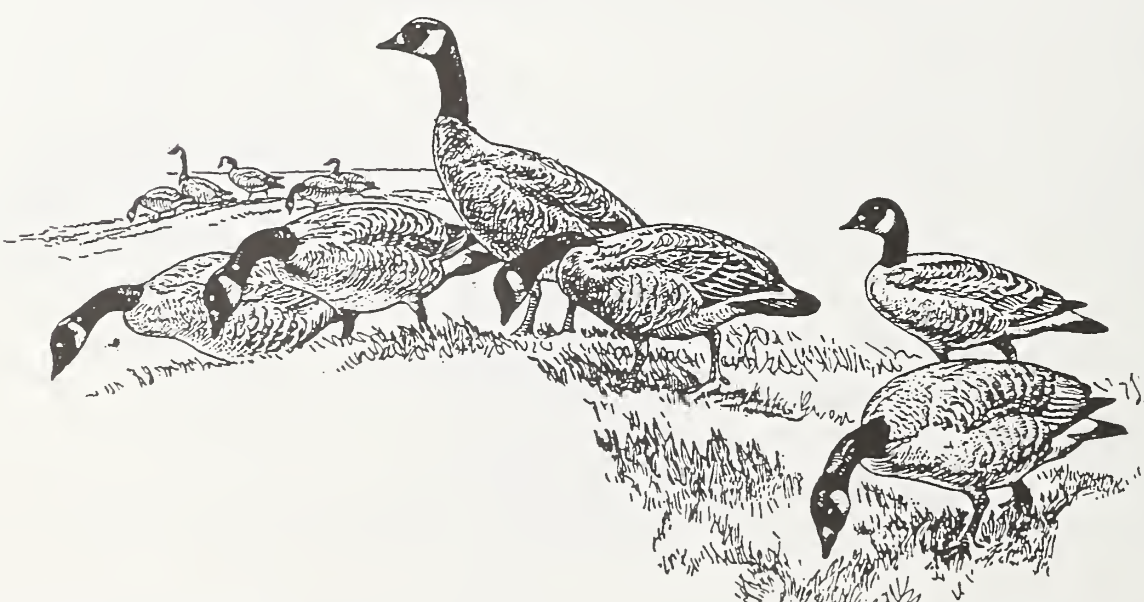


Figure 1-6
North Revilla Project Area Land Allocations as defined in the current TLMP (1979a, as amended)

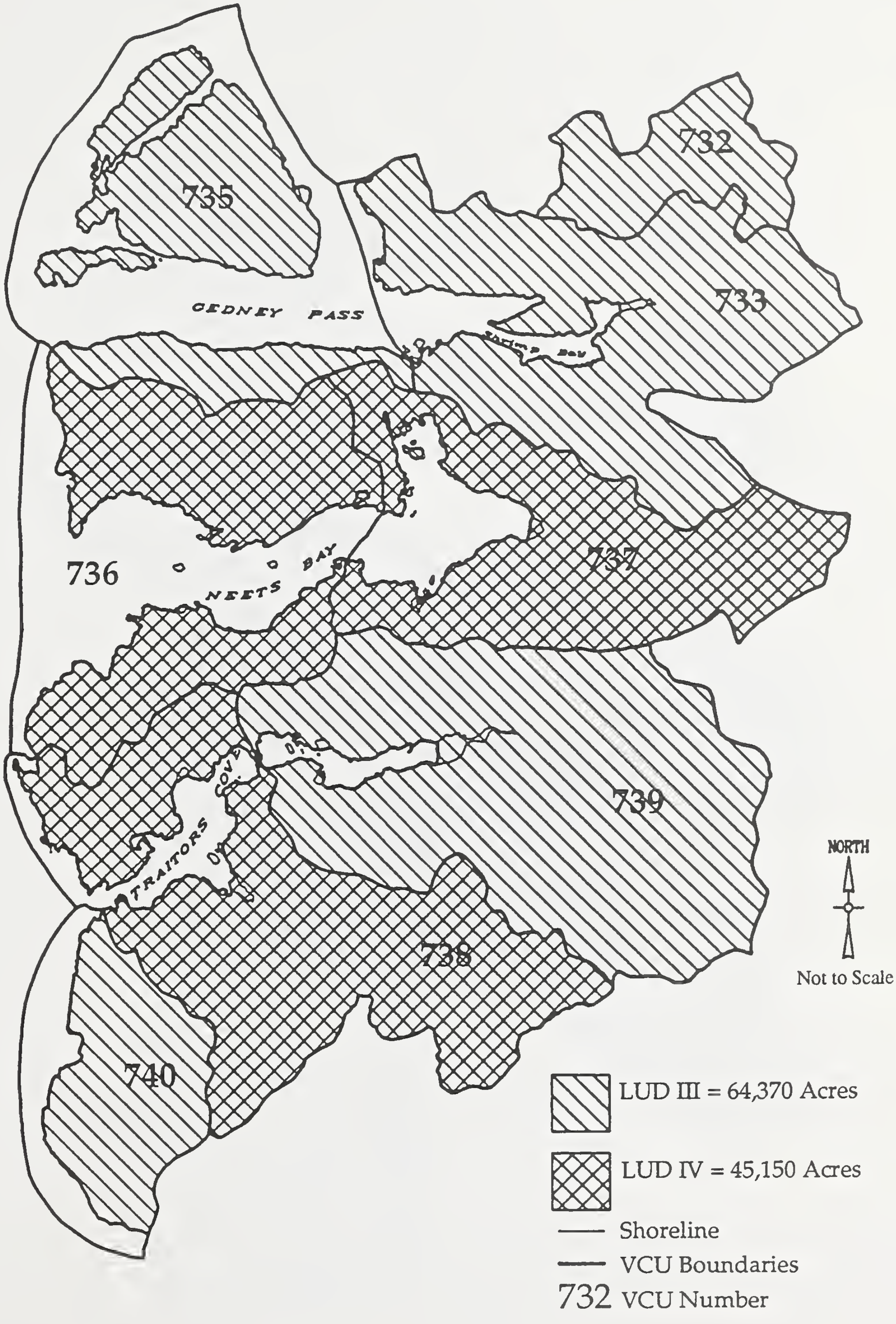
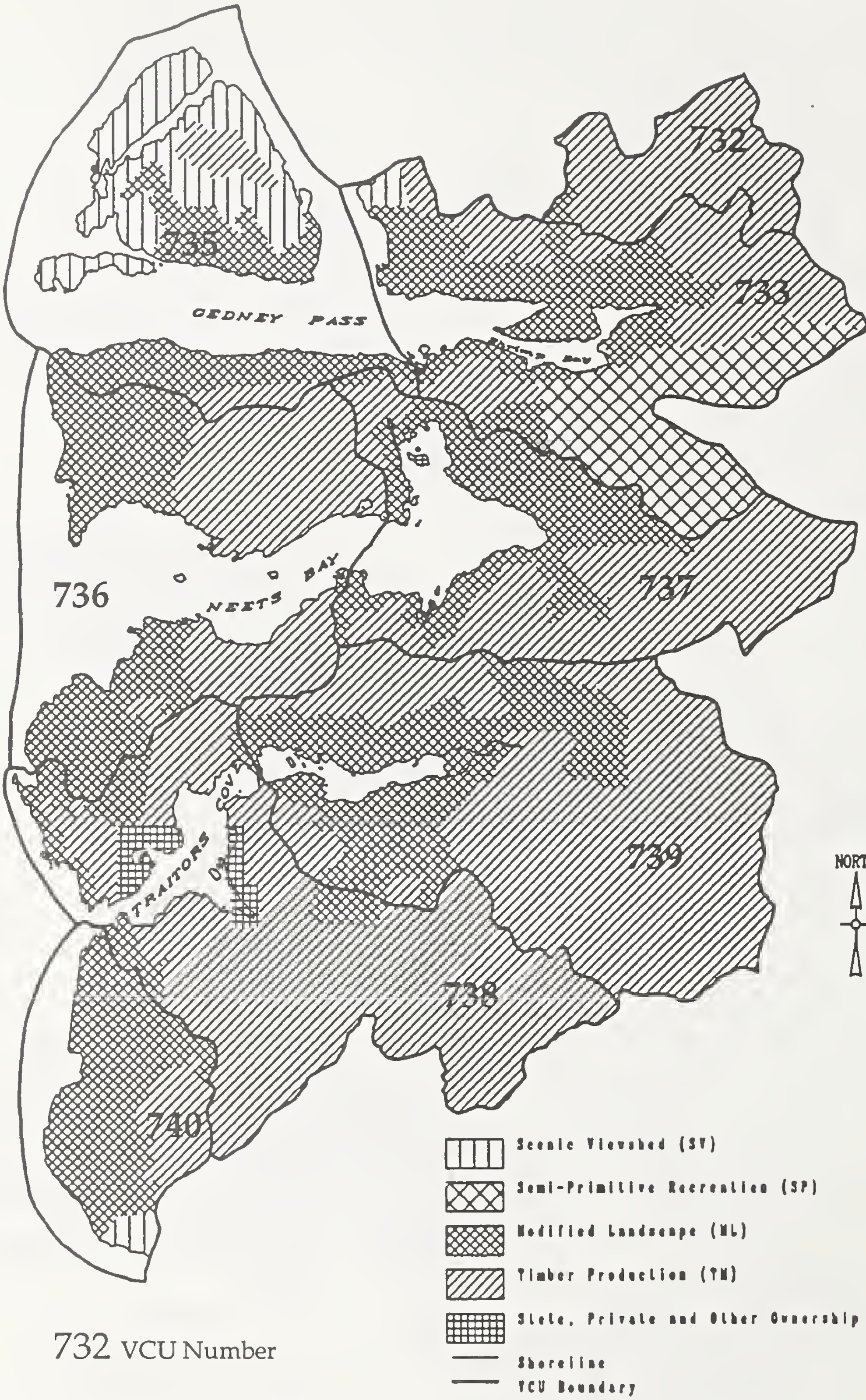


Figure 1-7
North Revilla Project Area Land Allocations as proposed in TLMP, Revision (1991a)



TLMP Revision

TLMP is currently undergoing revision as required by the NFMA. The TLMP Draft Revision (1991a) describes more specific LUD's, eight of which apply to the North Revilla Project Area. Management direction for the Revision LUD's and details of the Management Prescriptions are presented in the TLMP Draft Revision (1991a). For the purposes of the North Revilla EIS, references to the TLMP Draft Revision will mean Alternative P of the Revision Supplement to the Draft EIS unless otherwise noted. The TLMP Draft Revision LUD's and other land ownerships allocated in the Project Area are described below and presented in Table 1-3.

Alaska State Lands (AK)

Lands belonging to the State of Alaska.

Private Lands (PV)

Privately owned lands.

Semi-Primitive Recreation (SP)

The emphasis of this LUD is to provide semi-primitive recreation settings. This setting is characterized by predominantly natural or natural-appearing environments.

The Orchard Lake Area (portions of VCU 733) is assigned a Semi-Primitive Recreation (SP) management prescription. This prescription does not allow for commercial timber harvest. Therefore, none of the alternatives schedule harvest in the Orchard Lake viewshed as defined by the LUD boundary.

Scenic Viewshed (SV)

The emphasis of this LUD allows timber harvest while providing for scenic landscapes, vistas, and travel corridors in selected areas viewed from roads used primarily for recreational driving, trails, major marine travel routes, recreation sites, and popular bays and anchorages where forest visitors have high expectations for scenic quality. Recreation facilities may be present. This LUD may include landscapes that have been modified in the past, but future management will focus on restoring and maintaining scenic quality.

The northern half of Hassler Island has been identified a Scenic Viewshed LUD. The visual management objectives for the area will limit timber harvest similar to the existing LUD III.

Modified Landscape (ML)

The emphasis of this LUD is to provide a mix of management options, while minimizing the visibility of development activities in the foreground and allowing more development in the middle and background distances. This LUD provides for the scenic quality from selected travel routes and use areas by limiting the degree of visible change over time and space.

The vast majority of saltwater inlets and bays have been proposed for a Modified Landscape LUD. The Indian Point area (VCU 740) currently exceeds the proposed visual quality objective for the area and therefore, no timber harvest visible from the saltwater is proposed in this EIS. See the Visual Resources section in Chapter Three.

Timber Production (TM)

The emphasis of this LUD is for timber production. The primary objective is to manage the area, using silvicultural techniques, to maintain and promote industrial wood production. These lands will be managed to advance conditions favorable for the development of the timber resource and for maximum long-term timber production.

Beach Fringe and Estuary (BF)

The emphasis of this LUD is to manage natural beach fringe and estuary habitats to favor wildlife, fish, recreation, visual and other resources associated with beach fringe and estuary areas. Habitats for shorebirds, waterfowl, bald eagles, and other marine-associated species are emphasized. This LUD precludes timber harvest within a 500 foot slope distance of the beach and within a 1,000 foot slope distance of estuaries. Areas allocated to this LUD are incorporated into several other categories and are not presented separately in Table 1-2.

Streams and Lakes Protection (SL)

The emphasis of this LUD is to maintain riparian habitat for fish and other riparian-associated resources. This LUD applies to areas comprised of aquatic and riparian ecosystems, including riparian streamsides, lakes, and floodplains, as well as the zones of interaction between the riparian and upland terrestrial ecosystems. Conflicts in management activities are settled in favor of the riparian-associated fish and wildlife species. Areas allocated to this land use designation are incorporated into several other categories and are not presented separately in Table 1-2. Future management directions will refer to this classification as "Riparian" (RM).

Table 1-2 displays the Management Areas and management prescriptions within the Project Area, the VCU's, and the corresponding acres associated with each Land-Use Allocation.

Table 1-2
Land Use Designations as defined in TLMP Revision (1991a)

Management Area	VCU	TLMP Revision Management Practices				Total
		ML	TM	SV	SP	Total Acres
K32	732	150	4,640	0	0	4,790
K32	733	5,800	5,680	280	5,950	17,710
K32	735	4,210	1,300	4,580	0	10,090
K32	736	6,050	7,010	0	0	13,060
K32	737	5,450	8,370	0	0	13,820
K32	738	2,190	16,080	0	0	18,270
K32	739	7,790	17,540	0	0	24,330
K32	740	4,840	1,290	320	0	6,450
Total Acres Excluding Saltwater		36,480	61,910	5,180	5,950	109,520

ML — Modified Landscape
TM — Timber Production
SV — Scenic Viewshed
SP — Semi-Primitive Recreation
Beach Fringe and Estuary (BF) and Streams and Lakes (SL) Management Prescriptions will overlap each of the larger Land Use Designations
Note: Discrepancies may be found between tables due to rounding

Table 1-3
Summary Comparison of Proposed Land Use Designations (LUD's)

TLMP Revision	Management Prescriptions								
Land Use Designation (LUD)	Visual Quality Objective (VQO)	Recreation Opportunity Spectrum (ROS)	Access	Fisheries Improvement	Timber Management	Roads	Wildlife Habitats	Minerals Location & Leasing	Riparian
Semi-Primitive Recreation (SP)	Retention, Partial Retention	Semi-Primitive Motorized	Open	When Compatible with LUD Objectives	Not Suitable	Limited Transportation Network	Natural Distribution & Abundance of Habitat	Open	Maintained or Improved
Beach Fringe and Estuary (BF)	Retention, Partial Retention	Semi-Primitive Motorized & Non-Motorized	Open	Allowed	Not Suitable, Second-Growth Management if Previously Harvested	Case-by-Case Basis	Natural Distribution & Abundance of Beach Fringe & Estuary Habitats	Open	Maintained or Improved
Scenic Viewshed (SV)	Retention, Partial Retention	All	Open	When Compatible with Visual Objectives	Selection, Moderate Even-Aged Harvesting	Limited Transportation Network	All Ages of Habitats with Slow Reduction in Amount of Old Growth	Open	Located in Designation SL
Streams and Lakes Protection (SL)	Retention, Partial Retention, Modificaiton, Maximum Modification	Semi-Primitive Motorized, Rural, Roaded Natural	Open	Encouraged	No Harvest, Selection, Moderate Even-Aged Harvesting	Special Consideration	All Ages of Habitat with Majority of Old Growth Maintained	Open	Maintained or Improved
Modified Landscape (ML)	Partial Retention, Modification	Roaded, Natural and Modified	Open	Allowed	Group Selection, & Moderate or Intensive Even-aged Harvesting	Full Transportation Network	All Ages of Habitat with Slow Reduction in Amount of Old Growth	Open	Located in Designation SL
Timber Production (TM)	Modification, Maximum Modification	Roaded, Natural and Modified	Open	Allowed	Intensive Even-Aged Harvesting	Full Transportation Network	Early, Middle and Mature Habitats	Open	Located in Designation SL

State and private LUD's are not displayed.

How the North Revilla Project Area was Selected

This section explains the modifications to the Long-Term Contract and other management considerations that influenced the schedule of environmental analysis for the Ketchikan Administrative Area. North Revilla is one of several existing projects. See Appendix A for a complete rationale supporting the following discussion.

Background to Long-Term Timber Sale Contract

The 1950's marked a turning point for the timber industry in Southeast Alaska and established a template for production that remains in place today. The extensive search for new industrial development to offset a rapid decline in fishing and mining was rewarded with the signing of a 50-year timber contract in 1951. This contract underpinned the construction and operation of the first large-scale pulp mill in Southeast Alaska. The Ketchikan Pulp Company (KPC) was started as a two-party venture including American Viscose Corporation, the largest rayon manufacturer in the United States, and Puget Sound Pulp and Timber, a Bellingham firm. The mill obtained cutting rights for approximately 8.25 billion board feet of timber on the north half of Prince of Wales Island and the northwest portion of Revillagigedo (Revilla) Island. In exchange, the company agreed to build a mill of not less than three hundred tons per day operating capacity. A series of upgrades to the plant have since increased its capacity to 650 tons per day (200,000 short tons annually) [Durbak, pg. 34]. At the time it was built, the mill cost nearly $52.5 million to complete and represented the largest single industrial investment made in the Territory of Alaska (Rogers, 1960).

Six allotment areas exist on the Ketchikan Administrative Area for the Long-Term Contract. They are: Allotments E, F, and G (Primary Sale Area), Rest of Area E, Rest of Area F, and Rest of Area G. While the Long-Term Contract was not restricted to harvesting timber within the Primary Sale Area alone, the Primary Sale Area, Allotment F, was specifically set aside for use by KPC under the Long-Term Contract. The Long-Term Contract was divided into five-year operating periods in the mid-1960's and required redetermination of payment rates every five years. In conjunction with rate redetermination, an operating plan was developed which described the timber harvest and associated activities that would take place during the upcoming five-year period.

On November 28, 1990, President Bush signed into law the Tongass Timber Reform Act (TTRA P.L. 101-626). Among other provisions, Section 301 of this Act imposed unilateral changes to the Long-Term Contract with KPC to make it more consistent with independent National Forest timber sale programs. Consistent with unilateral changes resulting from TTRA that became effective in February 1991, timber now is made available for harvest from smaller timber offering areas. This is in contrast to preparing a single EIS for all contract operations for the five-year operating periods. Management requirements and the NEPA planning processes are to be consistent with those for the independent timber sale program.

The Long-Term Sale Contract between the USDA Forest Service and KPC expires June 30, 2004. As of October 1, 1991, the Forest Service is obligated to provide KPC with 2.5 BBF to meet remaining contractual commitments. Approximately 205 MMBF per year is needed to the expiration date.

Offerings specified after February 1991 must comply with the requirement of TTRA, including proportionality, streamside buffers, and other provisions.

KPC Contract Modifications Resulting from TTRA

The TTRA requires the Forest Service to follow a planning and environmental analysis process consistent with procedures for independent national forest timber sales (P.L. 101-626, Sec. 301.C1). Timber will be provided within the contract boundary in designated "timber offering areas." Offering areas may vary in size and may range from a portion or combination of individual watersheds or islands. The size is largely dependent on logical transportation systems and the amount of timber necessary to meet contract requirements. Offering areas are to be managed consistent with procedures for independent national forest timber sales, pursuant to the NFMA (P.L. 94-588), the NEPA (42 U.S.C. 4321 et seq.) and other applicable laws.

These timber offerings will be based on volume needed to meet contractual obligations stated in BO.52, B0.61, and B0.62 of the modified KPC contract. In part, B0.62 says the "Forest Service shall seek to specify sufficient Offerings to maintain a Current Timber Supply sufficient for at least three years of operations." This translates to approximately 615 MMBF for three years of normal timber stock; this amount is designed to allow KPC to schedule the flow of raw materials to their processing facilities.

Under KPC contract provision B0.31-Additional Areas, "the Regional Forester shall designate additional cutting areas within Pulptimber Allotments E, F, and G to meet such needs of such plans for the period ending June 30, 2004." The preferred alternative (Alternative P) in the Supplement to the Forest Plan Revision indicated that both the KPC contract area (Primary Sale Area) and Allotment areas Rest of E, F, and G would be needed to meet the timber volume contractual obligations. A tentative operating schedule was developed and approved for implementation based

on this analysis (see Appendix A). Areas within the KPC contract area are scheduled first, while the area outside the contract boundary is scheduled later as required under contract provision B0.31 as modified, February 1991. All management areas that are in a LUD III or IV (permits timber harvesting) area is scheduled to be harvested to some extent within the next 12 years to meet the needs of the KPC long-term sale and independent timber purchasers.

Summary

In summary, the North Revilla Project Area was selected for environmental analysis for the following reasons:

- The North Revilla Project Area is within the designated Primary Sale Area Allotment F for the KPC Long-term Contract, and contains a sufficient amount of harvestable timber volume designated as LUD III or IV, and therefore is appropriate for harvest under the TLMP (1979a, as amended). Available information indicates that harvest of the amount of timber being considered for this project can occur consistent with Forest Plan (TLMP 1979a as amended, and TLMP Draft Revision 1991a) standards, guidelines, and other requirements for resource protection. Consideration of areas outside the Primary Sale Area at this time is not necessary or reasonable.

- Other areas with available timber inside the designated sale area will be scheduled for harvest within the remainder of the KPC contract term (2004) in order to meet contract volume requirements. Effects on subsistence resources are projected to differ little according to which sequence these areas are subjected to harvest. Harvesting other areas on the Tongass National Forest with available timber is expected to have similar potential effects on resources, including those used for subsistence, because of widespread distribution of subsistence use and other factors. Harvest of these other areas is foreseeable, in any case, over the forest planning horizon under either the existing or draft revised Forest Plan.

There are four EIS's currently underway which comprise virtually all of the Primary Sale Area in the Ketchikan Administrative Area. Five additional projects are in the initial stages of development: Control Lake, Heceta, Upper Carroll, Three Creeks, and Sea Level. Another project was completed in 1991, but is scheduled for harvest by independent timber purchasers. These are listed below and presented in Figure 1-8.

North Sea Otter Sound ROD	Control Lake EIS	Three Creeks EIS
Central Prince of Wales EIS	Heceta Island EIS	Sea Level EIS
North Revilla EIS	Upper Carroll EIS	Polk Inlet EIS
Lab Bay EIS		

- Providing substantially less timber volume than required by the KPC contract in order to avoid harvest in the North Revilla Project Area or other project areas would not meet contract requirements and not fully implement the Forest Plan.

- It is reasonable to schedule harvest in the North Revilla Project Area at present rather than in other areas in terms of previous harvest entry and access, level of controversy over subsistence and other effects, and the ability to complete the NEPA process and make timber available to meet contract requirements by the time it is reasonably necessary to do so. Other areas that are reasonable to consider for harvest in the near future are the subject of other project EIS's that are currently ongoing or scheduled to begin soon.

For further details on why the North Revilla area was selected, see Appendix A.

Figure 1-8
Recent and Current Long-Term Sale EIS Projects

List of Recent and Current
Timber EIS

Map No.	EIS Project	Expected Completion
1	N. Sea Otter Sound	1992
2	Central Prince of Wales	1993
3	North Revilla	1993
4	Lab Bay	1993
5	Polk Inlet	1993
6	Control Lake	1995
7	Heceta	1995
8	Upper Carroll	1995
9	Sealevel	1996
10	3 Creeks	1996

Public Involvement

Scoping

The NEPA process (40 CFR 1501.7) was used to determine the scope of the issues to be addressed and identify major concerns related to the proposed action. The scoping process was used to invite public participation and collect initial comments. The public was invited to comment on the project through the following process.

Notice of Intent (NOI)

A Notice of Intent was published in the Federal Register on June 20, 1991, when it was decided that an EIS was to be completed for the project.

Public Mailing

On June 26, 1991, a letter providing information and seeking public comment (scoping document) was mailed to approximately 2,100 individuals and groups that had previously shown interest in Forest Service projects in Southeast Alaska. The mailing included 8 Federal agencies, 18 State agencies and divisions, 67 Native and municipal offices, and 213 businesses and other organizations and groups, in addition to individual citizens. Approximately 165 responses to this initial mailing were received.

Local News Media

Announcements about the project were printed in the *Ketchikan Daily News* and *Island News*. A scoping document describing the project was placed in the June 30, 1991 weekend edition of the *Ketchikan Daily News*. A press conference was held October 17, 1991 to discuss current planning projects on the Ketchikan Area of the Tongass National Forest, including the North Revilla EIS.

Second Public Mailing

On August 24, 1992, a second mailing was sent out to approximately 2,100 of individuals and groups from the initial mailing in June 1991. This letter summarized the significant issues derived from the initial public comment and outlined tentative alternatives to be analyzed in the Draft EIS. It also provided an opportunity for people to indicate how they would like to continue participation in the North Revilla planning process. Responses to this mailing became the basis for the Distribution List used to mail complete copies or summaries of the Draft EIS as requested. The Distribution List is in Chapter Four of this document.

Briefings

Additional briefings were held to provide information and clarification on issues and alternatives from February 1992 through November 1992 with representatives of Alaska Department of Fish and Game, Ketchikan Public Utilities, Ketchikan Pulp Company, Tongass Conservation Society, and the Alaska State Department of Natural Resources. In addition, a briefing was held at the executive board meeting of the Southern Southeast Regional Aquaculture Association (SSRAA) on October 2, 1992.

Draft EIS

- **Availability of Draft EIS for Public Comment.** Availability of the Draft EIS was announced in the *Federal Register* on December 24, 1992, with a deadline for public comment listed as February 12, 1993. Documents were mailed to the Distribution List in December 1992.

  An article regarding the North Revilla EIS and upcoming hearing dates, appeared in the *Ketchikan Daily News*, December 28, 1992. Additional announcements concerning Open Houses and Subsistence Hearings were placed through local radio stations, January 25 and 26th, 1993.

- **Subsistence Hearings**, were held in; Ketchikan, St John's Church, January 25, 1993, and Saxman, Saxman City Hall, January 27, 1993. Announcement of the times and locations of the hearings was included in the letter accompanying every document and was announced by public media as described above. Comments were recorded. Open houses to describe the analysis process and answer public questions were held in conjunction with the subsistence hearings.

  Meetings were held in February 1993, to document subsistence and other cultural information offered by William and Matilda Kushnick and Thomas Abbott, Native residents with intimate knowledge of the Project Area.

Final EIS

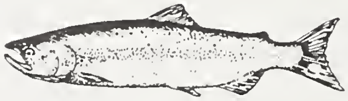
- **Response.** Approximately 875 individuals, agencies, and organizations submitted written comment on the North Revilla DEIS. In addition, 18 verbal testimonies were received at the two subsistence hearings. The 45-day comment period officially closed February 12, 1993; however, all letters were accepted, and with the comments, analyzed and incorporated into the FEIS as appropriate.

- **Third Public Mailing.** A third public mailing was sent to interested parties, providing an opportunity for people to indicate how they would like to continue participation in the North Revilla planning process. The mailing list consisted of the original list amended by responses to the first mailings and subsequent public meetings. Responses to that mailing will become the basis for the Distribution List used to mail copies or summaries of the Final EIS.

- The Final EIS has been filed with the Environmental Protection Agency and is available to the public.

  For a complete analysis of public comment and the Forest Service response to public comment, see Appendix L.

  Copies of the legal notices and newspaper articles, as well as comments received, are included in the project Planning Record.



Coho salmon

Issues Associated with the Proposed Action

The significant public issues, management concerns, and resource opportunities identified through the public and internal scoping process were used to formulate issues statements. Some of these issues were raised by the public, and some reflect Forest Service concerns. Similar issues and concerns were grouped when appropriate.

Issues 1–7 were determined to be significant and within the scope of the project. All these issues will be addressed in all alternatives. Issues A–E were considered but eliminated from detailed study because their resolution falls outside the scope of the North Revilla project.

Issue 1: Timber Economics

The timber issue addresses public concern for the amount of timber proposed for harvest and for economical entry into new stands while maintaining or enhancing resource values.

Issue 2: Fish Habitat and Water Quality

This issue addresses public concern for maintaining water quality in streams which provide suitable habitat for anadromous and resident fish. Fish and shellfish within the North Revilla Project Area are important to sport, commercial, and subsistence users throughout Southeast Alaska.

Issue 3: Recreation and Scenic Quality

Forest management activities could affect existing recreational pursuits for users of the North Revilla Project Area. More specifically, increased human access, timber harvest, and other developments could affect recreation values and opportunities including: hunting, fishing, scenic quality, and existing recreation facilities.

Issue 4: Wildlife

This issue includes concerns over several wildlife species and the habitats critical to the maintenance of those wildlife populations: Alaskan fish and wildlife are valuable for aesthetic, economic, recreational, ecological, or subsistence purposes. Of primary concern are the effects of timber harvest and associated road construction upon wildlife species dependent on old-growth habitat.

Issue 5: Subsistence

This issue reflects public concern for the availability of wildlife, marine life, and plants for use by rural Alaska residents. The Alaska National Interest Lands Conservation Act (ANILCA) specifically requires the Forest Service to evaluate the effects on subsistence uses and needs and the availability of other lands for purposes sought in this project. Subsistence is a complex issue which extends beyond the scope of the North Revilla Project Area.

Primary concern is the potential effects, as well as the cumulative effects, of timber harvest and road construction upon the abundance and distribution of subsistence resources. Other aspects to be evaluated are competition from non-rural subsistence users and access to the resources.

Issue 6: Social and Economic Effects

This issue reflects concerns about effects on community employment and income, population, community stability, and lifestyles. The economics of most communities in Southeast Alaska depend almost exclusively on the Tongass National Forest to provide natural resources for uses such as fishing, tourism, recreation, timber harvesting, mining, and subsistence. Many Southeast Alaskans want to maintain the natural environment which makes their lifestyle unique. At the same time, they want to continue maintaining their economic livelihood.

Issue 7: Marine Environment

The marine waters and their associated mud flats and estuaries found in protected coves and bays within the Project Area provide habitat for species such as Dungeness crab and juvenile salmon. Since coves and bays are the points of concentrated activity associated with marine transport of logs, logging camps, and sort yards, some marine species are subject to effects from log transfer and storage facilities. Nine LTF's are under consideration in the alternatives.

Issues Outside the Scope of This Analysis

The following public issues were considered but eliminated from detailed study because their resolution is beyond the scope of this document.

Issue A: Land Use Designations

Change TLMP Land Use Designations to eliminate, reduce, or increase the level of harvest and/or maximize specific resources.

Land use allocation is a Forest planning issue. The current Forest Plan is under revision and provides a forum for people who wish to see the area managed in a manner that differs from the current direction.

Issue B: Transportation Link

Evaluate the proposed transportation link and utility corridor that would provide access from Ketchikan to the northern portion of the island and across the Bradfield Canal.

The transportation and utility corridors have been identified in studies by R.W. Beck and the Ketchikan Gateway Borough. The Alaska legislature passed Senate Joint Resolution (SJR) 40 in 1992, urging the Forest Service not to preclude any of the identified transportation and utility corridors. The transportation and utility corridors are being considered in the current TLMP Revision process.

The North Revilla project contains a small portion of the two routes identified near Orchard Lake. The IDT reviewed the possibilities of the action being taken on the transportation and utility corridors in the foreseeable future. The review indicated that the corridor could be used for electrical transmission lines within the next decade. The review concluded that the road connections proposed are unlikely within the foreseeable future and that no actions proposed under any alternative would preclude use of any of the transportation and utility corridors.

The proposed transportation and utility corridors are separate from this project, outside the scope of this EIS, and will require a separate NEPA analysis. The North Revilla project is not linked to Ketchikan and is independent to any road linkage.

Issue C: Development outside the Project Area

Comments regarding the general level of development outside the Project Area are not considered issues ripe for decision under the North Revilla EIS. These areas include Cleveland Peninsula, Carroll River, and Orchard Creek (excluding Orchard Lake).

Issue D: Below Cost Timber Sales

Below-cost timber sales is a national issue and not within the scope of this project. The financial impacts of the alternatives, based on a mid-market analysis, are displayed in Chapter Three in this EIS.

Issue E: Timber Supply and Demand

Timber supply and demand is a regional issue and exceeds the scope of this analysis. A site-specific environmental analysis documents the effects of the proposed activities; it does not constitute the selling or conveyance of property rights. The volume of timber cleared in any NEPA document may be offered (sold) in part, in whole, or not at all.

The timber offered for sale (timber offerings) may occur in one year or be spread over a three- to five-year period. Therefore, trying to predict the effects of the proposed activities upon the regional timber supply or demand is beyond the capability and scope of this document.

For a complete discussion of all issues and comments expressed during the public review of the North Revilla Draft EIS, please refer to Appendix L.

Federal and State Permits, Licenses and Certifications

To proceed with the timber harvest as addressed in this EIS, various permits must be obtained from Federal and State agencies. Administrative actions on these permits would be initiated after the EIS is filed with the Environmental Protection Agency (EPA). The agencies and their responsibilities are listed below.

U.S. Army Corps of Engineers
- — Approval of discharge of dredged or fill material into waters of the United States (Section 404 of the Clean Water Act of 1977, as amended).
- — Approval of construction of structures or work in navigable waters of the United States (Section 10 of the Rivers and Harbors Act of 1899).

U.S. Environmental Protection Agency
- — Storm water discharge permit
- — National Pollutant Discharge Elimination System review (Section 402 of the Clean Water Act).

State of Alaska, Department of Natural Resources
- — Authorization for occupancy and use of tidelands and submerged lands.

State of Alaska, Department of Environmental Conservation
- — Certification of compliance with Alaska Water Quality Standards (Section 401 Certification).
- — Solid Waste Disposal Permit (Section 402 of Clean Water Act).

U.S. Coast Guard
- — Coast Guard Bridge Permit (in accordance with the General Bridge Act of 1946) required for all structures constructed across navigable waters of the U.S.

Legislation and Executive Orders Related to This EIS

Shown below is a brief list of laws pertaining to preparation of EIS's on Federal lands. Some of these laws are specific to Alaska, while others pertain to all Federal lands.

- National Historic Preservation Act of 1966 (as amended)
- Wild and Scenic Rivers Act of 1968, amended 1986
- National Environmental Policy Act (NEPA) of 1969 (as amended)
- Clean Air Act of 1970 (as amended)
- Alaska Native Claims Settlement Act (ANCSA) of 1971

- Marine Mammal Protection Act of 1972
- Endangered Species Act (ESA) of 1973 (as amended)
- Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974 (as amended)
- National Forest Management Act (NFMA) of 1976 (as amended)
- Clean Water Act of 1977 (as amended)
- American Indian Religious Freedom Act of 1978
- Alaska National Interest Lands Conservation Act (ANILCA) of 1980
- Archeological Resource Protection Act of 1980
- Cave Resource Protection Act of 1988
- Tongass Timber Reform Act (TTRA) of 1990
- Executive Order 11988 (floodplains)
- Executive Order 11990 (wetlands)

In addition, the Coastal Zone Management Act (CZMA) of 1976, as amended, pertains to the preparation of an EIS. Federal lands are not included in the definition of the coastal zone as prescribed in the CZMA. However, the Act requires that when Federal agencies conduct activities or development that affects the Coastal Zone, that agency's activities or development be consistent to the maximum extent practicable with the approved State Coastal Management Program. This determination is made by the U.S. Forest Service.

The Alaska Coastal Management Plan incorporated the Alaska Forest Resources and Practices Act of 1979 as applied standards and guidelines for timber harvesting and processing. The Forest Service Standards and Guidelines and Mitigation Measures described in Chapter Two of this document are equal to or exceed State Standards.

Availability of the Planning Record

An important consideration in preparation of this EIS has been reduction of paperwork as specified in 40 CFR 1500.4. In general, the objective is to furnish enough site-specific information to demonstrate a reasoned consideration of the environmental impacts of the alternatives and how these impacts can be mitigated.

The Planning Record is available upon issuance of the EIS at the Forest Supervisor's office, Ketchikan, Alaska. Other reference documents such as the Tongass Land Management Plan (TLMP, as amended 1979a), the Tongass Land Management Plan Revision DEIS (TLMP 1991a), the Tongass Timber Reform Act, the Resources Planning Act, and the Alaska Regional Guide EIS, are available at public libraries around the region as well as at the Supervisor's Office in Ketchikan.

Chapter 2
Alternatives

Outline

Chapter 2

Alternatives

Key Terms

Alternative - one of several policies, plans, or projects proposed for decision making
BMP's - Best Management Practices - practices used for the protection of water quality
Desired Future Condition - A concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed.
FTE - Full Time Equivalent
Habitat Conservation Area (HCA) - contiguous blocks of wildlife habitat to be managed and conserved for breeding pairs, connectivity, and distribution of species of concern
Implementation monitoring - collecting information to evaluate whether mitigation measures were carried out in the manner called for
MELP - Multi Entry Layout Plan - interdisciplinary design and mapping of all potential timber harvest units, including associated logging and transportation systems
Mitigation - measures designed to counteract or lessen environmental impacts
MMBF - a million board feet
Partial cut - harvest of timber using silvicultural prescription other than clearcut; examples include shelterwood, seed tree, and group selection
Roadless area - an area of undeveloped public land identified by the TLMP Draft Revision (1991a) within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.
Subsistence - the customary and traditional uses by rural Alaskan residents of wild renewable resources for direct personal or family consumption
Windfirm - individual trees that are able to resist windthrow or the configuration of harvest units so as not to create an opening which exposes the adjacent stand of timber to the direction of the major prevailing storm wind (southeast)

Introduction

Chapter Two summarizes the development of alternative actions for making timber available to the Ketchikan Pulp Company (KPC), while implementing the Tongass Land Management Plan (TLMP 1979a, as amended) in the North Revilla Project Area. It also discusses the alternatives considered but eliminated from detailed study. Finally this chapter explains and compares the six alternative actions selected for detailed study. Chapter Two is intended to present the alternatives in comparative

form, thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public (40 CFR 1502.14).

Much of the information in Chapter Two is summarized from Chapter Three, Environment and Effects. Chapter Three contains the detailed scientific basis for establishing a baseline and measuring the environmental consequences for each of the alternatives. For the best understanding of the six alternatives, readers should consult Chapter Three.

Changes to Alternatives between DEIS and FEIS

There has been a refinement in the site-specific information available for analysis in the Final EIS (FEIS), compared to what was available at the time the Draft EIS (DEIS) was published. Refined information has been incorporated into the Final EIS in order to make the proposed harvest units more site specific, as well as to make the units selected for each alternative more closely align with the alternative theme. The unit cards in Appendix K, display the unit configuration, layout direction, and mitigation measures that apply to each unit.

There are five general sources of improved information:

- Forest Service field reconnaissance including stand exams, cultural resource surveys, logging feasibility and road location, soils and wildlife, etc.
- Public response to the Draft EIS (approximately 877 responses; see Appendix L);
- Subsistence hearings in Ketchikan and Saxman communities;
- GIS information used in the analysis was updated to reflect new information or increased accuracy;
- Classification of approximately 385 miles of previously unclassifed streams. This information was incorporated into the unit configuration, mitigation and analysis. The new streams are depicted on the unit cards.

Improved Analysis

In addition to incorporating this refined information, the Final EIS strengthened and expanded many of the discussions contained within the analysis based on public and internal comment. The resource analysis within the Final EIS represents an improvement over what was presented in the Draft EIS. The following summarizes some of the more significant revisions by resource. The FEIS:

Timber

- updates mid-market economic analysis to include shovel logging and revised helicopter yarding costs;
- improves unit card maps;
- expands harvest data and Appendix A to include information on completion of first rotation through year 2050, instead of 2004;
- adds road cards

Wildlife

- implemented a strategy (integrates Forest Plan, latest research and project level analysis) for maintaining well-distributed, viable populations of wildlife, as recommended by the Interagency Viable Population Committee, and displays proposed Habitat Conservation Areas (HCA's);
- deer analysis considers effect of increased hunter demand on deer availability and displays ADFG population objectives;
- assumes a sustainable harvest rate of 40 percent for marten and 20 percent for river otter;
- adds gray wolf to MIS list;
- includes Appendix D, Biological Assessment.
- the effects of road densities and possible connection of the Project Area roads to the Ketchikan road system were analyzed in the cumulative (beyond reasonably foreseeable) effects section for marten, black bear and gray wolf.

Soil, Water, Air

- recalculates cumulative effects for watershed disturbance, on both a VCU basis and a third order watershed basis;
- adds an sediment delivery risk analysis to address public concern for SSRAA (Neets Creek) and Traitors Creek.

Social & Economic

- improves socio-economic section;
- displays employment trends for timber and other industries;

Marine Environment

- improves LTF discussion and analysis, including material in Appendix G;
- incorporates field reconnaissance and provides a discussion on the tradeoffs between road connections or new LTF's in Traitors Cove.

Recreation & Visuals

- improves analysis of the effects of timber harvest on the visual quality near Hassler Island.

Alternative Development

Each action alternative presented in this EIS is a different response to the significant issues discussed in Chapter One. For this EIS, five action alternatives were developed to meet the stated purpose and need of the project, while minimizing or avoiding environmental impacts. Each action alternative represents a site-specific proposal developed through intensive interdisciplinary unit and road design using high resolution topographic maps, GIS mapping capabilities, and new 1991 aerial photos coupled with resource inventories and site inspections.

Ecosystem Management

Ecosystem management seeks to focus research and management of the national forests to provide a full array of social values and benefits, with increased emphasis on fisheries, wildlife, recreation, ecological sustainability, and long-term productivity.

New perspectives is contained within the larger concept of ecosystem management. New perspectives is an attempt to use a variety of silvicultural strategies and re-evaluate older ones, to bring about a different balance in resource production in managed landscapes. The basic philosophy of new perspectives is to mimic natural ecological processes and maintain options for future management while we learn more about the impacts of our management on the ecosystem.

Ecosystem management looks at forest management on two levels: (1) the landscape level, which may be a geological province (geoprovince) or a large watershed; and (2) the stand level, which deals with individual harvest units. The forest plan incorporates ecosystem management at the landscape level through land use allocation and the development of Standards and Guidelines. This separates incompatible uses, and spreads impacts out over time and space. Many issues—such as maintaining large unfragmented blocks of old growth over time and maintaining the connectivity between those blocks—can only be resolved over the entire rotation through the land use allocation or forest planning process. A site-specific project level plan evaluates the assumptions made in a higher level plan. It then implements that direction and responds to public comments through the development of alternatives which determine which stands are treated and how they are managed. Some tools employed at the stand level may include a deferred entry, reducing harsh edges through unit placement, looking for opportunities to retain small patches of uncut timber in harvest units (where feasible and practical), maintaining existing travel corridors, leaving snags in harvest units (where safety regulations allow), and trying nonstandard harvest practices where resource issues and physical limitations permit.

Process Used to Formulate Alternatives

A systematic, interdisciplinary approach was used in developing alternatives for making timber available. The scoping process for the North Revilla Project Area began in July 1991 and concluded in September of 1991. Alternative formulation began after completion of the scoping process and was designed to address public issues, Forest Service concerns, and opportunities identified in scoping.

The Draft EIS for this project was released in December 1992. The intent of releasing a draft EIS is to allow the public to comment on the alternatives so that the agency can respond to the comments and consider the public input in making a final decision on the proposed action. A total of 859 written responses to the Draft EIS were received. Eighteen more people expressed their opinions about the project during subsistence hearings in Saxman and Ketchikan, Alaska. The Saxman subsistence hearing generated a third meeting. In February 1993 representatives/individuals from Saxman (William Kushnik, Matilda Kushnik, and Thomas Abbott) met with the IDT to identify important subsistence use areas within the planning area. All of this public input is considered in the final decision for this project (see the Record of Decision). In response to public comments, some sections of the EIS have been expanded, and corrections have been made in other sections. Specific responses to public comments are documented in Appendix L. All alternatives have been modified to varying degrees to address public comments and concerns. The following general guidelines were used to formulate alternatives:

1. **Address the Issues Identified During the Scoping and Public Comment Periods.** This ensures that the interests of the various citizens, groups and organizations that could be affected by this project are reflected in the alternatives.

2. **Integrated Resource Analysis Focused on the Proposed Action.** Forest Plan implementation begins with a comparison of the existing condition with the management emphasis for the area, and is followed by a determination of what, if any, changes are necessary. The purposes of integrated resource analysis are to determine possible combinations of management practices that are responsive to identified changes and to ensure that these combinations are consistent with Forest Plan direction.

   Adherence to Forest Plan objectives and standards is an essential component of Forest Plan implementation [36 CFR 219.10(e);36 CFR 219.11(c)]. The key Forest Plan standards establish limits on adverse environmental impacts and require that unless specified levels of mitigation can be achieved, a project or activity won't be proposed. Thus the list of possible management practices which would work toward the desired future condition for timber must be consistent with the need to meet Forest Plan standards and objectives for other resources.

3. **Evaluate a Reasonable Range of Alternatives** The issues, the ways of addressing the issues, and possible levels of resource use on Revilla Island vary widely. The ID Team concentrated on providing a range of alternatives by varying the location and mixes of resources committed under each alternative and by varying the number and kinds of activities to be conducted.

   Section 102(2)(e) of NEPA states that all Federal agencies shall "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." These unresolved conflicts, identified by the Forest service and the public, are the NEPA issues related to the proposed action.

   In addition to responding to unresolved conflicts, an EIS must "rigorously explore and objectively evaluate all reasonable alternatives" [40 CFR 1502.14(a)]. The courts have established that this direction does not mean that every conceivable alternative must be considered, but that selection and discussion of alternatives must permit a reasoned choice and foster informed decision making and informed public participation.

   Taken together, these requirements determine the NEPA range of alternatives.

   Upper limits on timber outputs and associated road mileages considered in this EIS are imposed by Tongass Land Management Plan (TLMP 1979a, as amended) standards and guidelines for other resources as well as legal obligations on timber harvest set out in 36 CFR 219.27 and Section 6(g)(3)(e) of the National Forest Management Act.

   Lower limits on timber outputs and associated road mileages are directly related to the purpose and need for action described in Chapter One.

4. **Conform to TLMP Revision Supplement Draft EIS, Alternative P (USDA Forest Service 1991a) standards and guidelines.** This DEIS was developed consistent with the standards and guidelines in Alternative P of the

TLMP Draft Revision (1991a). The documented analysis and relevant discussion from this set of documents has been incorporated by reference rather than repeated (40 CFR 1502.21).

5. **Follow an Interdisciplinary Process.** This systematic, interdisciplinary approach ensures the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on the environment.

Alternatives Eliminated from Detailed Study

A number of alternatives were examined, but not considered for detailed study in this Draft EIS. This section presents those alternatives and the rationale for not considering them further.

Alternative A

Single Resource or Issue Alternatives that focused upon one resource or issue were eliminated from consideration as implementable alternatives. While alternatives constructed around a single resource may not be implementable, the issue itself may still be significant. Each alternative will be evaluated against all the significant issues.

Alternative B

Transportation/Utility Corridor between Ketchikan and the Project Area The proposed road link and utility corridor are separate projects and independent from this EIS. The road link project is not reasonably foreseeable. The transportation/utility corridor is not a connected action, and will require a separate NEPA document displaying the issues and alternatives developed during the public involvement process.

Alternative C

Harvest in the Orchard Lake area The Interdisciplinary Team received numerous comments during scoping about the need to protect Orchard Lake. The same comments were received during the TLMP Revision process. Under Alternative P of the TLMP Draft Revision (1991a) the area is now proposed for management under the Semi-primitive Recreation (SP) management prescription, which does not allow for timber management. Forest transportation system linkages are allowed for under the Semi-primitive land use designation. However, no transportation linkages are proposed inside the management prescription boundary under any of the action alternatives at this time.

Alternative D

Inability to Meet the Purpose and Need Several public comments requested the Forest Service analyze a reduced harvest within the North Revilla Project Area. Because of the defined purpose and need of the project, a significantly lower volume alternative was not considered in detail (see item #3 under the Process Used to Formulate Alternatives, discussed earlier in Chapter Two). Additional information on why lower volumes were not considered is included in Appendix A, and summarized in Chapter One under the section titled "How the North Revilla Project Area was Selected".

Alternative E

Public Comment Alternative Several public comments requested the Forest Service eliminate specific areas or individual units that were of concern to them. For example, the Southern Southeast Aquaculture Association (SSRAA) identified units they felt posed a sedimentation risk to the fish hatchery at Neets bay, several elders from the community of Saxman identified important subsistence use areas, other individuals and groups identified units that they felt would negatively impact water quality, visual quality, or wildlife values. The North Revilla IDT decided to apply these comments against Alternative 2. Alternative 2 consists of 251 MMBF which represents the maximum amount of timber harvest that could be achieved and still meet Forest Plan standards and guidelines. After removing the units which were of concern to the public, this alternative contained 92 harvest units, totaling 106 MMBF of sawlog plus utility volume from 3,637 acres. It proposed 30 MMBF scheduled for helicopter yarding. The overall nature of the alternative was fairly disjointed and would have been grossly uneconomical. This alternative was dropped from further consideration because it clearly failed to meet the stated purpose and need for the project.

The public comments were incorporated into the various alternatives to varying degrees. For example alternative 4 in the DEIS was dramatically altered to address wildlife and subsistence comments, while still meeting the purpose and need for the project. Alternatives 4, 5 and 6 all deferred harvest in the Traitors Cove HCA wildlife block. The North West Traitors Cove (LTF #18) and North Traitors Cove (LTF #22) LTF's were dropped from all alternatives. Numerous other changes were incorporated into each individual alternative based in part on public comments received on the Draft EIS.

Alternatives Considered for Detailed Study

Six alternatives for making timber available to KPC from the North Revilla Project Area were considered in detail. Each alternative is consistent with the TLMP (1979a, as amended) and Alternative P of the TLMP Draft Revision (1991a). For each alternative this section provides a discussion of: (1) the emphasis or intent of the alternative, (2) various resource outputs associated with implementation, (3) environmental consequences, and (4) guidelines used in selecting units and roads consistent with the emphasis. Alternatives are compared in detail later in this chapter and summarized in Table 2-1.

Alternative 1 (No Action)

Emphasis The emphasis of this alternative is to propose no new timber harvest from the North Revilla Project Area for the Long-Term Contract at this time. It does not preclude timber harvest from other areas at this time, or from the North Revilla Project Area at some time in the future. The CEQ regulations 40 CFR 1502.14d requires a "No Action" alternative be analyzed in every EIS to serve as a benchmark by which effects of the other action alternatives are to be measured. The Existing Condition map (Alternative 1), in the separate map packet, shows the distribution of vegetation associated with no new timber harvest.

Outputs There are no new timber harvest outputs associated with this alternative. Visual quality, wildlife habitat quality, semi-primitive recreation opportunities, as well as other resource values would remain at their current condition.

Guidelines There were no units selected for this alternative.

Alternative 2

Emphasis The emphasis of this alternative is to accelerate progress toward the desired future condition for timber management while meeting Forest Plan Standards and Guidelines for other resources. Timber volume made available to KPC is maximized this entry under this alternative. This alternative is designed to evaluate the effects of harvesting as much of the Project Area as possible in a combination that still meets standards and guidelines. This alternative serves as an upper level benchmark that can be used to project the cumulative affects of the reasonably foreseeable future activities (see Appendix A) within the Project Area.

Outputs Implementation of this alternative would schedule the harvest of 8,232 acres, in 205 harvest units for approximately 251 MMBF of sawlog and utility volume, indicating and average unit size of 40.2 acres. Of this harvest, 9 units totaling 295 acres are planned for partial cut; the remainder are planned for clearcut harvest. To implement this level of harvest 153.4 miles of new road would be constructed, and 45.6 miles of existing road would require reconstruction. Road construction clearing will yield an additional 16 MMBF of right-of-way (ROW) volume. This indicates an average of 1.7 MMBF per mile of new road construction and a total of 1.3 MMBF per mile of road. It schedules 1,711 acres or 51.8 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-18.84 per MBF.

The development of one new Log Transfer Facility (LTF) and six existing LTF's will be required to implement this alternative. Floating logging camps are anticipated with the Margaret, Fire Cove and Shrimp bay LTF's. The road connection between Margaret Bay and Fire Cove (Traitor's Creek) would eliminate the need for an additional floating camp at Fire Cove. The Alternative 2 map, provides the spatial relationship among roads, units and other geographic features of the North Revilla Project Area.

Planning Criteria Criteria used in selecting units and roads consistent with the emphasis of Alternative 2 include the following:

Emphasize timber production and road access by harvesting in all watersheds that contain suitable timber.

Emphasize roaded modified recreation opportunities throughout the Project Area.

Economics of timber harvest is not a primary consideration: Utilize nonstandard yarding systems, including helicopters, where feasible, to access all available timber.

Concentrate harvest in the higher volume classes while meeting the proportionality direction contained in the Tongass Timber Reform Act (TTRA).

Concentrate harvest through the use of large clearcuts (within NFMA and Forest Plan constraints).

Alternative 3

Emphasis The objective of this alternative is to emphasize timber economics and conventional cable yarding methods. The location of harvest units, selection of silvicultural prescriptions, logging systems, and a transportation network is primarily based on maximizing the mid-market value. This entry does not propose any

helicopter timber harvest. This approach emphasizes a positive net economic return for the proposed harvest units, by seeking to minimize logging and road construction costs.

Outputs Alternative 3 schedules the harvest of 124 individual harvest units, totaling 174 MMBF of sawlog and utility volume from 5,734 acres, indicating an average unit size of 46.2 acres. Of this harvest no partial cutting or helicopter yarding is proposed. This alternative requires the construction of 103.0 miles of new specified roads plus 32.3 miles of reconstruction. Road construction clearing will yield an additional 8 MMBF of right-of-way (ROW) volume. This indicates an average of 1.8 MMBF per mile of new road construction and a total of 1.3 MMBF per mile of specified road. Preliminary analysis indicates a net mid-market stumpage value of $16.03 per MBF.

The development of one new Log Transfer Facility (LTF) and six existing LTF's will be required to implement this alternative. Floating logging camps are anticipated with the Margaret, Fire Cove and Shrimp bay LTF's. The road connection between Margaret Bay and Fire Cove (Traitor's Creek) and the Shrimp Bay to Bluff Lake road connnections would not be built as part of this alternative. The Alternative 3 map, provides the spatial relationship among roads, units and other geographic features of the North Revilla Project Area.

Planning Criteria Criteria used in selecting units and roads consistent with the emphasis of Alternative 3 include the following:

Defer Timber harvest in units scheduled for helicopter or long span skyline (over 2000 feet) yarding.

Maximize volume available through conventional cable yarding systems and construct the minimum amount of associated new roads and bridges necessary to achieve the stated purpose and need.

Construct roads to the minimum standard required to harvest timber.

Concentrate harvest in the higher volume classes while meeting the proportionality direction contained in the TTRA.

Concentrate harvest through the clearcut harvest method. Large clearcuts will be utilized where other resource values allow. NFMA and Forest Plan requirements for clearcut size limitations will be followed.

Alternative 4

Emphasis The emphasis of this alternative is to meet the stated purpose and need while configuring planned harvest units throughout the Project Area to reduce harvest of high value wildlife habitat and to maintain the integrity of large, unfragmented blocks of old-growth forest to the extent practicable. This approach emphasizes a deferral of harvest within the most valuable wildlife habitats, subsistence use areas, and seeks to minimize the effects of forest fragmentation.

Outputs Alternative 4 schedules the harvest of 123 individual harvest units, totaling 178 MMBF of sawlog plus utility volume from 5,920 acres, indicating an average unit size of 48.1 acres. Of this harvest, 5 units totaling 204 acres are planned for partial cut; the remainder are planned for clearcut harvest. This alternative requires the

construction of 94.8 miles of new specified roads plus 26.2 miles of reconstruction. Road construction clearing will yield an additional 9 MMBF of right-of-way (ROW) volume. This indicates an average of 2.0 MMBF per mile of new road construction and a total of 1.5 MMBF per mile of specified road. It schedules 1,545 acres or 47.2 MMBF of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-4.63 per MBF.

The development of one new Log Transfer Facility (LTF) and five existing LTF's will be required to implement this alternative. Floating logging camps are anticipated with the Margaret, Fire Cove and Shrimp bay LTF's. The road connection between Margaret Bay and Fire Cove (Traitors Creek) would not be built under this alternative. The Alternative 4 map provides the spatial relationship among roads, units and other geographic features of the North Revilla Project Area.

Planning Criteria Criteria used in selecting units and roads which would be consistent with the emphasis of Alternative 4 include the following:

Place greater emphasis on wildlife corridors between HCA's and vertical corridors between different elevation zones.

Maintain key wildlife areas including but not limited to high value deer winter range.

Concentrate harvest at high elevations and on north and east aspects to the extent practicable.

Concentrate timber harvest in the lower volume class stands.

Minimize construction of new roads, bridges and log transfer facilities.

Avoid impacting high quality old-growth redcedar sites near shorelines that may have important subsistence/cultural values.

Maintain large blocks of old-growth winter range habitat by concentrating harvest through the use of large clearcuts if it enhances wildlife values.

Defer harvest in the Traitors Cove HCA.

Alternative 5

Emphasis The emphasis of this alternative is to meet the stated purpose and need while configuring planned harvest units throughout the Project Area to minimize impact on visually sensitive areas. Units will be more dispersed, less visible and are designed to blend into the characteristic landscape.

Outputs Alternative 5 schedules the harvest of 188 individual harvest units, totaling 193 MMBF of sawlog plus utility volume from 6,424 acres, indicating an average unit size of 34.2 acres. Of this harvest, 6 units and 143 acres are planned for partial cut; the remainder are planned for clearcut harvest. This alternative requires the construction of 136.5 miles of new specified roads plus 36.9 miles of reconstruction. Road construction clearing will yield an additional 15 MMBF of right-of-way (ROW) volume. This indicates an average of 1.5 MMBF per mile of new road construction and a total of 1.2 MMBF per mile of road. It schedules 830 acres or 24.4 MMBF

of volume for helicopter yarding. Preliminary analysis indicates a net mid-market stumpage value of $-22.53 per MBF.

The development of one new Log Transfer Facilities (LTF) and six existing LTF's will be required to implement this alternative. Floating logging camps are anticipated with the Margaret, Fire Cove and Shrimp bay LTF's. The road connection between Margaret Bay and Fire Cove (Traitor's Creek) would not be built under this alternative. The Alternative 5 map, provides the spatial relationship among roads, units and other geographic features of the North Revilla Project Area.

Planning Criteria Criteria used in selecting units and roads which would be consistent with the emphasis of Alternative 5 include the following:

Minimize activity in inlets and bays to the extent practicable.

Minimize timber harvest in seen areas. Utilize smaller created openings and widely dispersed units. Emphasize gentle or flat topography to help screen units.

Locate road construction and timber harvest activities to avoid unique recreation places and sites. Attempt to avoid activities in close proximity to recreation facilities, and other areas of recreational use such as streams, lakes and beaches. Minimize the number and size of harvest units in areas visible from saltwater, lakes or recreation facilities.

Defer harvest in the Traitors Cove HCA.

Alternative 6

Emphasis The emphasis of this alternative is to meet the defined purpose and need by configuring planned harvest units throughout the Project Area to provide for an economically viable timber harvest, while seeking to minimize the effects on high value wildlife habitat, key recreation and ongoing research areas (Margaret Lake Fish Pass).

Outputs Alternative 6 schedules the harvest of 137 individual harvest units, totaling 198 MMBF of sawlog plus utility volume and 6,568 acres indicating an average unit size of 47.9 acres. Of this harvest, 4 units totaling 222 acres are planned for partial cut; the remainder are planned for clearcut harvest. It proposes 1,113 acres and 33.9 MMBF of helicopter yarding. This alternative requires the construction of 97.7 miles of new specified roads plus 33.6 miles of reconstruction. Road construction clearing will yield an additional 8 MMBF of right-of-way (ROW) volume. It achieves 2.1 MMBF per mile of new road construction and 1.6 MMBF per mile of specified road construction. Preliminary analysis indicates a net mid-market stumpage value of $17.50 per MBF.

The development of one new Log Transfer Facility (LTF) and six existing LTF's will be required to implement this alternative. Floating logging camps are anticipated with the Margaret, Fire Cove and Shrimp Bay LTF's. The road connection between Margaret Bay and Fire Cove (Traitors Creek) and the Shrimp Bay to Bluff Lake road connnections would not be built as part of this alternative. The Alternative 6 map provides the spatial relationship among roads, units and other geographic features of the North Revilla Project Area.

Planning Criteria Criteria used in selecting units and roads which would be consistent with the emphasis of Alternative 6 include the following:

Minimize harvest levels near saltwater inlets and bays.

Minimize the amount of road and bridge construction necessary to achieve the stated purpose and need.

Concentrate harvest in the higher volume classes while meeting the proportionality direction contained in the TTRA.

Minimize the harvest of high quality deer winter range.

Utilize the most economical yarding systems consistant with resource protection needs, including helicopter and long span skyline.

Minimize harvest levels adjacent to Margaret Lake.

Defer harvest in the Traitors Cove HCA.

Preferred Alternative

Using an evaluative process that compares the benefits and adverse effects of each alternative against the issues, the USDA Forest Service has identified Alternative 6 as the preferred alternative for this EIS. A final determination will be made by the Ketchikan Area Forest Supervisor in the Record of Decision (ROD).

Comparison of Alternatives

The comparison of alternatives draws together the conclusions from the analysis presented throughout the document and provides a summary of the results. Table 2-1 provides a summary of activities, outputs, and environmental consequences by which the alternatives may be compared. The following sections provide a comparison of alternatives by: (1) proposed activity (2) significant issue, and (3) other environmental consequence.

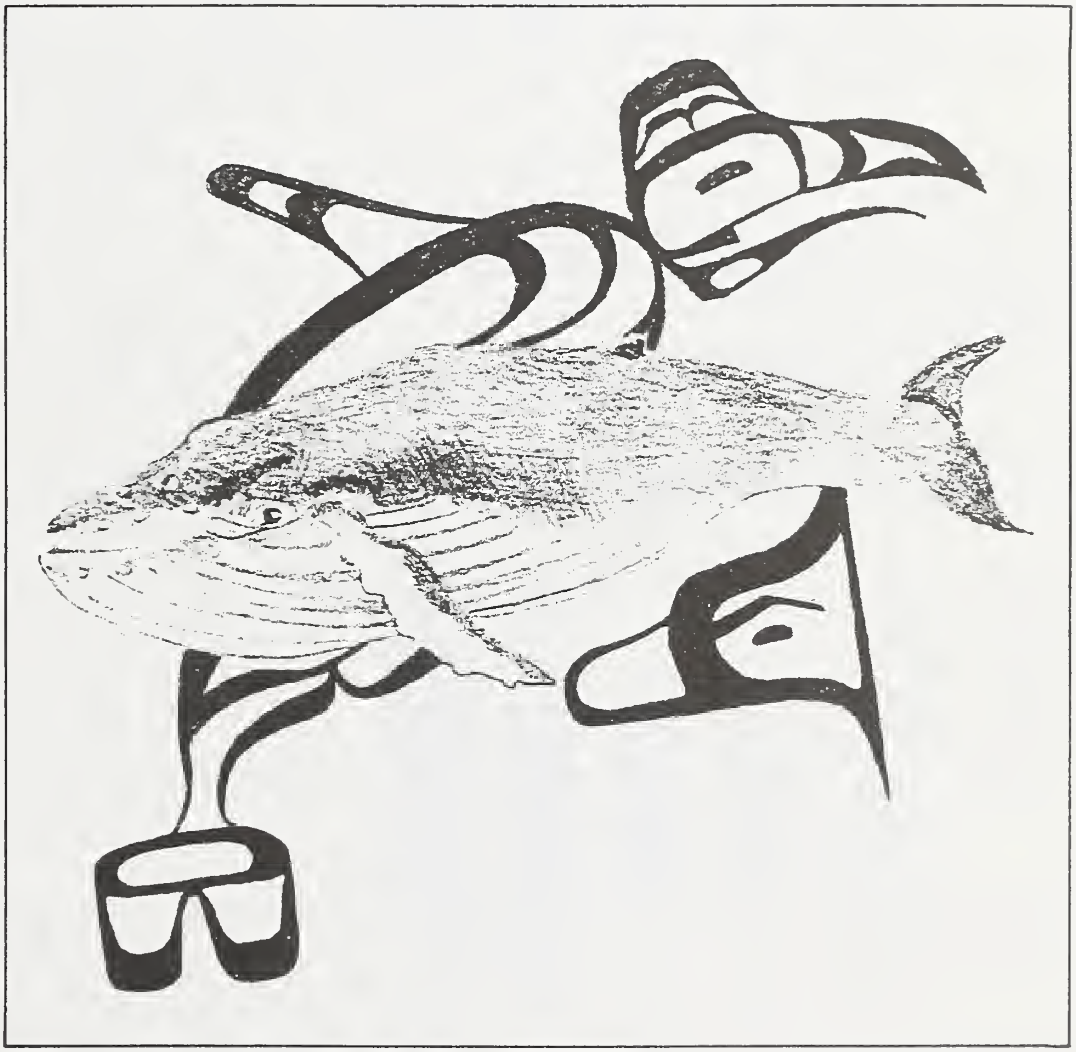


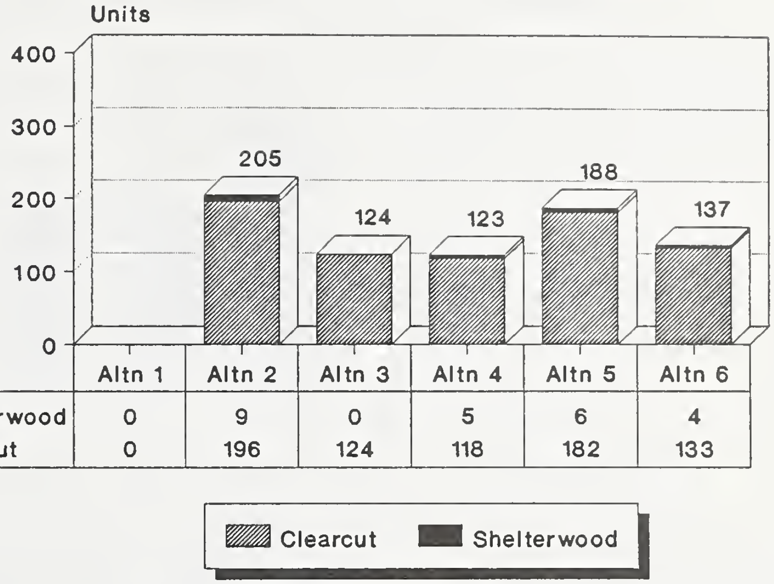
Table 2-1
Summary Comparison of Alternatives

Activity	Units	Alternatives 1	2	3	4	5	6
Timber							
Units	Number	0	205	124	123	188	137
Estimated harvest unit volume	MMBF	0	251	174	178	193	198
Estimated right-of-way (ROW) volume	MMBF	0	16	8	9	15	8
Partial cut (shelterwood)	Acres	0	295	0	204	143	222
Clearcut harvest	Acres	0	7,937	5,734	5,716	6,281	6,346
Total harvest	Acres	0	8,232	5,734	5,920	6,424	6,568
Units over 100 acres	Number	0	8	9	7	4	7
Highlead harvest	MMBF	0	78.0	66.7	39.3	66.7	61.9
Running Skyline	MMBF	0	84.8	71.9	62.5	69.9	68.4
Live Skyline (Shotgun)	MMBF	0	1.6	0.5	1.3	2.4	1.2
Slackline harvest	MMBF	0	34.5	35.0	27.5	29.4	33.1
Helicopter harvest	MMBF	0	51.8	0	47.2	24.4	33.9
Estimated stumpage	$ / MBF	0	-18.84	+16.03	- 4.63	-22.53	+17.50
Proposed Proportionality Remaining	Percent	8.86	8.82	8.87	8.91	9.05	8.95
Receipts to State of Alaska	$M	0	5,969	5,048	4,094	4,975	5,046
Avg. annual jobs over 4 years	# of jobs	0	579	395	405	450	448
Roads & Transportation							
Specified road constr.	Miles	0	153	103	95	137	98
Road reconstruction	Miles	0	46	32	26	37	33
New Log Transfer Facilities	Each	0	1	1	1	1	1
Reconstruction of Log Transfer Facilities	Each	0	6	6	6	6	6
Margaret/Fire Cove Road connection	Miles	0	1.0	1.7	0	2.5	1.7
Margaret/Fire Cove Road connection	$M	0	$ 350	$ 520	$ 0	$ 710	$ 520
Shrimp/Bluff road connection* *(Cost included in stumpage)	Miles	0	12.3	0.8	8.3	12.1	0.8
Roads crossing Cl.I,II streams	Number	0	80	52	60	71	52
Biodiversity							
High & Moderate use subsistence (TRUCS)	Acres harvested	0	0	0	0	0	0
Unfragmented old-growth blocks >10,000 Ac.	Acres	49,505	31,184	34,716	33,241	34,584	32,997
Old Growth Acres Remaining	Acres	56,927	48,342	51,158	50,043	49,759	50,251
Wildlife - Project Area							
1997 MIS - deer	Habitat capability	1,700	1,592	1,615	1,617	1,628	1,602
1997 MIS - bear	Habitat capability	182	180	181	181	180	180
1997 MIS - marten	Habitat capability	144	127	131	133	132	130
1997 MIS - river otter	Habitat capability	66	65	65	65	65	65
1997 MIS - hairy woodpecker	Habitat capability	1,051	874	919	933	921	909
1997 MIS - Vancouver Canada goose	Habitat capability	243	219	227	225	223	222
1997 MIS - bald eagle	Habitat capability	137	135	136	136	136	136
1997 MIS - brown creeper	Habitat capability	1.338	1,131	1,192	1,205	1,197	1,178
1997 MIS - red squirrel	Habitat capability	70,793	63,214	63,635	63,750	63,627	63,540
1997 MIS - gray wolf	Habitat capability	4	4	4	4	4	4
Soils							
Very high mass movement	Acres harvested	0	216	225	203	162	266
High mass movement	Acres harvested	0	4,047	2,317	2,833	3,158	2,162
Medium mass movement	Acres harvested	0	2,380	2,025	1,414	1,809	2,162
Low mass movement	Acres harvested	0	1,533	1,174	1,356	1,251	1,301
Wetlands harvested/roaded	Acres	0	3,413	1,568	1,577	2,202	1,749
Roadless Areas							
Change in ROS class from SPNM to RM	Acres	0	15,605	7,216	12,190	11,788	9,403
Roadless areas	Acres (thousands)	61,394	43,345	52,843	48,672	47,734	51,930
Recreation places with some harvest	Number	0	12	11	10	12	11
Harvest in Orchard Lake viewshed	Acres	0	0	0	0	0	0

Comparison of Alternatives by Proposed Activity

The action alternatives propose the harvest of from 123 to 205 individual units. Alternatives 2 proposes the most units for partial cutting (9), while Alternative 3 proposes no partial cutting. Figure 2-1 shows the number of units proposed for harvest under each alternative, by silvicultural system.

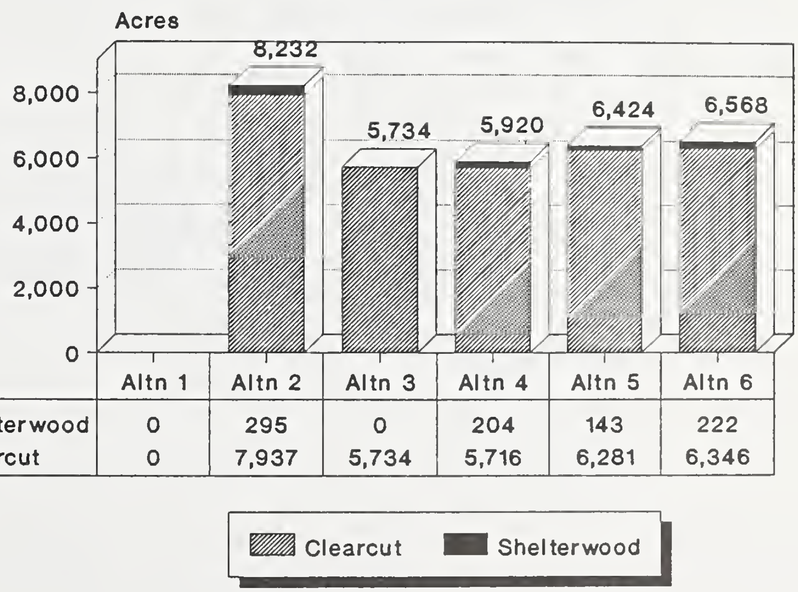
Figure 2-1
Number of Units Proposed for Harvest, by Silvicultural System



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Shelterwood	0	9	0	5	6	4
Clearcut	0	196	124	118	182	133

Each action alternative, with the exception of Alternative 2, proposes approximately 6,000 acres of timber harvest. Figure 2-2 shows the number of acres proposed for harvest by each alternative by silvicultural system.

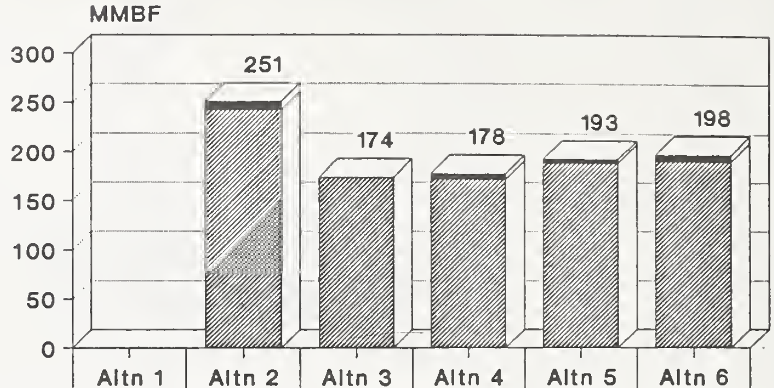
Figure 2-2
Total Acres Proposed for Harvest, by Silvicultural System



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Shelterwood	0	295	0	204	143	222
Clearcut	0	7,937	5,734	5,716	6,281	6,346

Excluding right-of-way volume each action alternative, except Alternative 2, generated slightly less volume than the identified purpose and need of 200 MMBF. Alternative 3 comes within 13 percent at 174 MMBF and Alternative 2 exceeds by 26 percent with 251 MMBF. Figure 2-3 shows the volume of timber proposed for harvest by each alternative by silvicultural system.

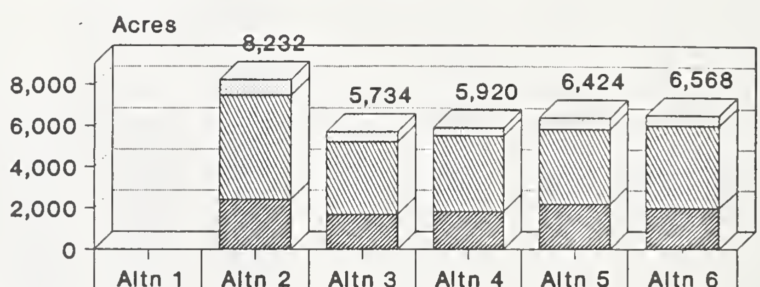
Figure 2-3
Total Volume Proposed for Harvest



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Shelterwood	0	9	0	6	4	7
Clearcut	0	242	174	172	189	191

Commercial forest land is divided into Volume Class Strata according to the Ketchikan Area's timber type map. This volume class information is used in calculating volume harvested and economic analysis. Figure 2-4 shows volume class strata breakdown for each alternative.

Figure 2-4
Proposed Harvest by Volume Class Strata



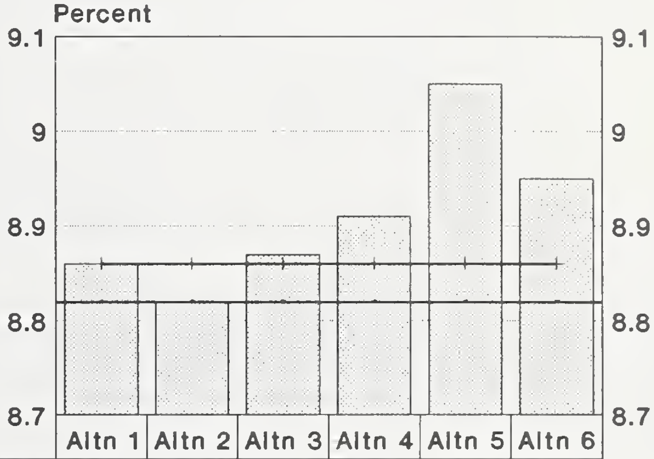
	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Volume Class 7	0	0	0	0	16	0
Volume Class 6	0	762	507	383	533	515
Volume Class 5	0	5,050	3,517	3,698	3,664	4,058
Volume Class 4	0	2,420	1,710	1,839	2,211	1,995

The Tongass Timber Reform Act of 1990 modified the long-term contracts to:

> Eliminate the practice of harvesting a disproportionate amount of old-growth timber by limiting the volume harvested over the rotation in Volume Classes 6 and 7, as defined in TLMP and supporting documents, so that the proportion of volume harvested in these classes within a contiguous Management Area does not exceeed the proportion of volume currently represented by these classes within the Management Area.

The Project Area is completely within Management Area K32 and contained 8.82 percent proportion of volume class 6 and 7 timber, as of November 1990 (Date TTRA became law). The current proportionality is 8.86 percent. All alternatives would result in a proportionality in excess of 8.82 percent and will meet the intent of the TTRA.

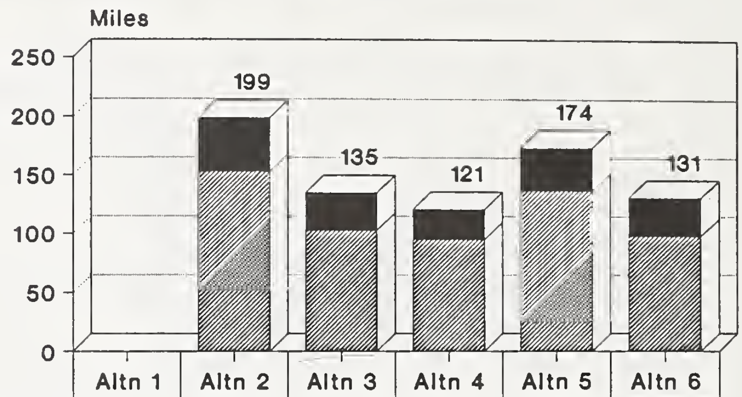
Figure 2-5
Proportion of Volume Class 6 & 7 Remaining after Harvest



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Proposed Proportion	8.86	8.82	8.87	8.91	9.05	8.95
Existing Condition	8.86	8.86	8.86	8.86	8.86	8.86
TTRA Proportion	8.82	8.82	8.82	8.82	8.82	8.82

Road development is divided into two main categories—construction and reconstruction. Figure 2-6 shows the number of miles of new road construction and reconstruction proposed to access the harvest units for each alternative.

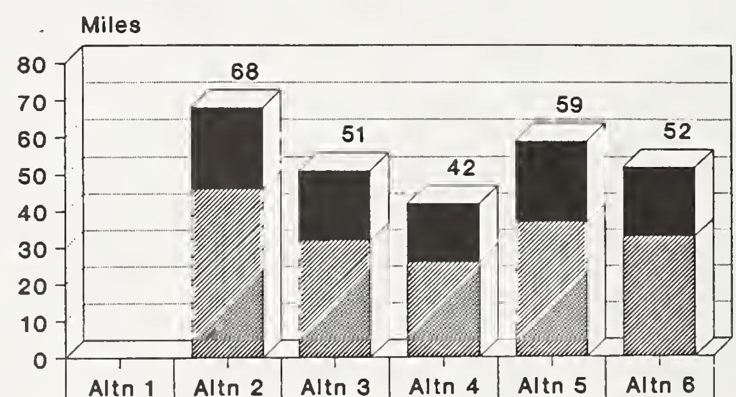
Figure 2-6
Proposed New Road Construction & Reconstruction



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Reconstruction	0	46	32	26	37	33
Construction	0	153	103	95	137	98

Road reconstruction and prehaul maintenence are used to describe the intensity of effort and materials necessary to rebuild the existing roads to meet Forest Service standards for log haul. Figure 2-7 shows the number of miles of road reconstruction and prehaul maintenance necessary to access the harvest units for each alternative.

Figure 2-7
Proposed Road Reconstruction & Prehaul Mtc.



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Prehaul Mtc.	0	22	19	16	22	19
Reconstruction	0	46	32	26	37	33

There are six existing LTF's and one new LTF's required to harvest the timber proposed for each alternative. This analysis has roughly estimated which units or groups of harvest units would most economically be hauled to a given LTF. Actual haul may be different. Table 2-2 shows the volume of harvest projected to be hauled to each LTF.

Table 2-2
Proposed Harvest, by Existing & New Log Transfer Facility, in MMBF

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Hassler Island	0	19	17	19	9	20
Klu Bay	0	22	10	14	21	16
Shrimp Bay	0	30	11	39	37	14
Chin Point*	0	16	18	17	11	19
Fire Cove	0	63	54	24	51	56
SW Neets	0	19	19	0	16	20
Margaret Bay	0	71	45	52	48	48
Log barge**	0	11	0	12	0	6

SOURCE: Rhodes, 1992
* New Log Transfer Facilities
** Helicopter logging to a barge

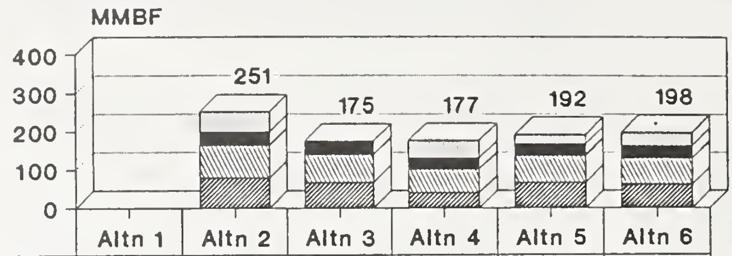
Comparison of Alternatives by Significant Issue

Chapter One presents in detail the significant issues that are the focus of this EIS and the key indicators for evaluating the impacts of timber harvest on each issue. This section compares the alternatives in terms of these issues. The baseline for comparing alternatives is Alternative 1, the no-action alternative. Chapter Three contains the detailed evaluation of the potential effects of timber harvest and road construction activities under each alternative on forest resources.

Issue 1: Timber Harvest Economics

Estimated timber economics focuses on the residual value (stumpage) of the timber after all associated logging and transportation costs are subtracted. Generally, the most expensive logging method is helicopter, followed by slackline, highlead, live skyline (shotgun), running skyline and shovel yarding. Yarding distance, uphill versus downhill yarding, volume per acre, species composition and value, in combination with other factors will influence the relative cost of each yarding method. Helicopter yarding is necessary in areas where it is impractical to build road or where aerial logging is necessary to meet specific standards and guidelines. Alternative 2 proposes the most helicopter volume (52 MMBF), while Alternative 3 proposes none. Figure 2-8 compares the logging systems proposed for each alternative.

Figure 2-8
Timber Harvest by Logging System



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Helicopter	0	52	0	47	24	34
Slackline	0	34	35	28	29	33
Live Skyline	0	2	1	1	2	1
Running/Skyline	0	85	72	62	70	68
Highlead	0	78	67	39	67	62

Based on the analysis of timber values in the Timber section of Chapter Three, only alternatives 3 and 6 show a positive net stumpage, with Alternative 6 having the highest value by a small margin. Table 2-3 compares the economics of timber harvest in dollars/thousand board feet ($/MBF) for each alternative under mid-market conditions (generally representing the average market condition and product mix, during the period from 1979 to the current quarter). The mid-market conversion expresses the net dollar value of the timber volume after subtracting the production costs from the mid-market log value including road, bridge and LTF construction costs. The table also displays the road, bridge and LTF costs in terms of millions of dollars (MM$).

Table 2-3
Estimated Mid-market Stumpage Value

Components	Alternative 1	2	3	4	5	6
Mid-Market Conversion Rate ($/MBF)	0	-18.84	+16.03	- 4.63	-22.53	+17.50
Road, Bridge & LTF Construction Costs (MM)	0	29.4	17.9	17.8	24.8	17.3

SOURCE: Rhodes, 1993
* Costs included in the mid-market conversion rate

Issue 2. Fish Habitat and Water Quality

There is no measurable effect on water quality or fisheries production by any of the timber harvest or associated activities proposed by any of the action alternatives. All alternatives meet the requirements and intent of the Clean Water Act. Implementation of proposed fish habitat enhancement projects for each alternative could increase the habitat for fish production. Implementation of the TTRA's requirement to provide a minimum 100-foot buffer on Class I streams and Class II streams flowing directly into Class I streams would effectively mitigate direct stream channel impacts from proposed timber harvest and road construction. Adherence to BMP's outlined in the Soil and Water Conservation Handbook (USDA FSH 2509.22) during the design of units and roads will minimize the potential direct effects to fish as well. Site-specific BMP's were developed and selected to minimize the potential for impact to fish habitat. These site-specific BMP's are noted on the individual Harvest Unit and Road Design cards in Appendix K.

Fish habitat capability models are used to estimate the effects of timber harvest on the capability of streams to provide habitat for selected species of salmon and trout. Because there are many factors which influence fish populations—including commercial/sport harvest, oceanic conditions, and predation—these computer models provide only relative measures of habitat capability. These models indicate that there is no change in habitat capabilities for coho and pink salmon, or for Dolly Varden char, and the species which they represent, among the alternatives, including the no-action alternatives.

Every major watershed (VCU) within the Project Area has experienced prior roading and road construction. Re-entering these drainages may generate a greater potential risk for impacts on water quality, with the risk expected to be greater in those watersheds with the higher cumulative percents of harvest. The standards and guidelines associated with Alternative P of the TLMP Revision Supplement to the Draft EIS (TLMP Draft Revision 1991a) limit the amount of timber harvest within a given watershed to 35 percent of the total land base within a 15-year period. Table 2-4 shows the existing, direct and indirects effects of timber harvest and road construction by third order or larger watershed.

Table 2-4

Cumulative Watershed Effects, Percentage of Watershed Harvested and Roaded in Third Order or Larger Watersheds

Watershed Number	Watershed Harvested and Roaded 1982-1997					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
C11A	0	10	3	3	11	3
C12A	0	12	12	12	5	12
C13A	7	5	2	5	4	5
C30A	0	4	2	3	3	0
C33A	0	0	0	8	0	8
C34A	0	12	14	13	8	16
C40C	0	0	0	0	0	0
C41B	0	10	1	11	10	2
C43A	0	3	0	20	23	0
C59B	5	8	7	0	8	9
C60C	5	9	8	2	5	7
D13A	6	4	2	6	6	2
D57B	3	13	8	9	10	9
D58C	0	17	6	1	4	1
D67A	0	0	1	0	0	0

SOURCE: Babik, 1993

Table 2-5 displays the percent of high gradient contained stream channels (Channel types HC1, HC2, HC3, HC4, HC5, HC6) which have been harvested or proposed for harvest during the period of 1977-1997, in third order or larger watersheds. The Forest Plan Revision limits cumulative harvest rates in this land use designation to 25 percent or less every 20 years of a third order or larger watershed.

Table 2-5
Cumulative Watershed Effects, Percentage of High Gradient Contained Process Group Harvested

Watershed Number	Process Group Harvested 1977-1997					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
C11A	0	10	4	4	14	4
C12A	0	16	16	16	5	16
C13A	12	16	0	16	14	15
C30A	0	0	0	0	0	0
C33A	0	0	0	13	0	13
C34A	0	19	18	25	0	18
C40C	0	0	0	0	0	0
C41B	0	5	0	7	5	1
C43A	0	1	0	15	25	0
C59B	9	15	13	15	14	16
C60C	12	17	13	14	15	17
D13A	9	10	11	16	16	11
D57B	4	16	12	12	12	11
D58C	0	10	8	0	0	0
D67A	0	0	0	0	0	0

SOURCE: Babik, 1993

Another measure of potential risk to fish habitat from timber harvest is the associated new road construction and road reconstruction which crosses streamcourses (see Chapter Three-Fisheries). During placement of culverts or bridges, sediment may be introduced into the streams which may have short- or long-term effects on water quality. Alternative 4 proposes the fewest stream crossings, while Alternative 2 proposes the most. This is shown in Table 2-6.

Table 2-6
Stream Crossings to be Constructed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Class I	0	44	28	29	42	27
Class II	0	64	54	33	55	49
Class III	0	219	147	116	186	124
Total Crossings	0	327	229	178	283	200

SOURCE: Rhodes, 1993

Following timber harvest, there is an increased risk of landslides until second growth and the brush layer become firmly established. One way of analyzing this risk is to determine the amount of timber harvest on slopes which have high mass movement index (MMI) soils. This rating does not imply that such a mass-wasting event will occur; rather, it ranks the alternatives on the basis of the potential for a mass-wasting

event to occur, which may or may not result in an increase in stream sediment. This increased stream sedimentation may result in some loss or impairment of resident and anadromous fish spawning and rearing habitat. Table 2-7 shows the proposed harvest on high MMI (MMI = 3) and very high MMI (MMI = 4) soils by alternative. Virtually all very high MMI soils have been removed from the base. Only those sites that appear to be small inclusions or mistyped have been retained in the unit pool. These sites will be examined by a professional soil scientist as part of unit layout.

Table 2-7
Acres of High Hazard Soils Harvested, by Alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Very High MMI soils	0	216	225	203	162	266
High MMI soils harvested*	0	4,047	2,317	2,833	3,158	2,162

SOURCE: Babik, 1993
* See Chapter 3-Soils for details of MMI classifications.

Issue 3. Recreation and Scenic Quality

There are 16 key viewsheds within the Project Area. The proposed visual quality objectives (VQO's) for this project establish the minimum visual quality management standards for these key viewsheds.

Table 2-8 shows the proposed VQO's for each key viewshed, and the percent change in visual cumulative disturbance level by alternative. Alternative 1 represents the existing visual condition. In all viewsheds for all alternatives, the proposed harvest units achieve the proposed visual quality objectives.

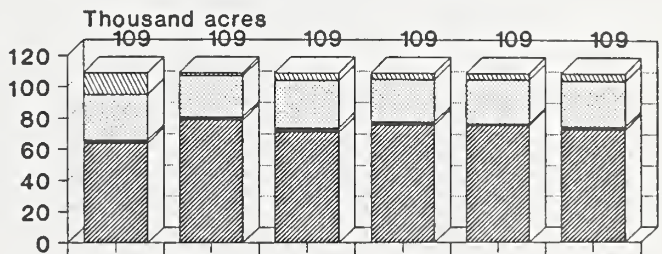
Table 2-8
Proposed VQO's and Changes in Cumulative Visual Disturbance

Viewshed	Proposed VQO*	Changes in Percent Visual Condition* Alt.1**	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Behm/Indian Pt	PR-M	0	0	0	0	0	0
Behm/Traitors	PR-M	0	2	3	3	5	3
Traitors Cove	M-MM	0	16	17	5	9	17
Margaret Cove	M-MM	0	21	12	8	9	9
Inner Traitors	PR-M	0	7	6	4	4	6
SW Neets Bay	PR-M	0	1	3	0	2	4
NW Neets Bay	PR-MM	0	11	10	9	5	10
Inner Neets Bay	M-MM	0	5	5	7	7	7
Head/Neets Bay	PR-M	0	10	6	11	11	6
Behm/Gedney Pass	PR-M	0	5	2	8	0	5
Shrimp Bay	PR-M	0	5	0	8	2	4
Klu Bay	PR-M	0	12	7	10	8	11
Orchard Lake	PR	0	0	0	0	0	0
Behm/W.Hassler	R-PR	0	7	9	7	2	10
Behm/N.Hassler	R-PR	0	13	11	17	10	12
S.Hassler Pass	PR-M	0	15	11	12	6	11

SOURCE: Angelus, 1993
* R = Retention; PR = Partial Retention; M = Modification; MM = Maximum Modification
** Alternative 1 represents the existing condition

Implementing any of the action alternatives will change the existing Recreation Opportunity Spectrum (ROS) class within the Project Area. Figure 2-9 shows the change in ROS class by alternative.

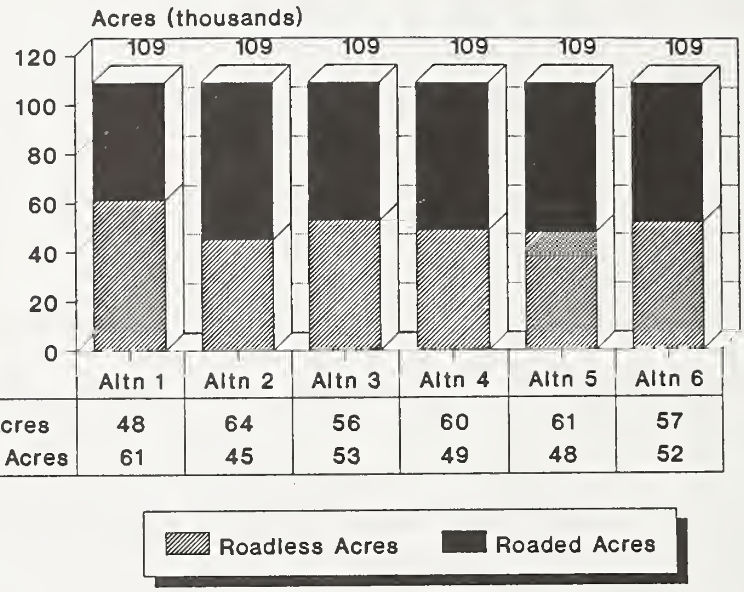
Figure 2-9
Changes in ROS Class, by Alternative



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Primitive	14	2	5	4	4	5
Semi-prim. non-motor	29	26	30	27	28	29
Roaded natural	2	2	3	2	1	2
Roaded modified	64	79	71	76	76	73

The TLMP Draft Revision (1991a) identified three roadless areas which lie within or partially within the Project Area. The impact of timber harvesting on roadless areas is much larger than the acres harvested because the sights and sounds associated with the harvest activity affect the surrounding area. Roadless areas generally need to be at least 5,000 acres in size, or the area is no longer considered roadless. Figure 2-10 shows the number of roadless area acres that will remain after implementation of an alternative.

Figure 2-10
Timber Harvest within Roadless Areas



	Altn 1	Altn 2	Altn 3	Altn 4	Altn 5	Altn 6
Roaded Acres	48	64	56	60	61	57
Roadless Acres	61	45	53	49	48	52

Issue 4. Wildlife habitat

The major effect on wildlife habitats in all action alternatives is the reduction of old-growth forest habitat. Impacts to other habitats were reduced by the interdisciplinary design of units prior to alternative formulation. All alternatives result in impacts consistent with the implementation of the TLMP (1979a, as amended) and Alternative P of the TLMP Draft Revision Supplement to the Draft EIS (TLMP Draft Revision 1991a), standards and guidelines.

Table 2-9 shows the potential reduction in wildlife habitat capabilities, as estimated by habitat capability models, for the key Management Indicator Species (MIS) found in the North Revilla Project Area. This table displays the 1954 long-term habitat capability and estimated short-term reduction in habitat capability after potential implementation of the alternatives.

Table 2-9
Potential Changes in Habitat Capability within the Project Area for MIS in 1997

Species	Habitat Capability 1954	Habitat Capability 1993	Changes from 1993 by Alternative 1	2	3	4	5	6
Sitka b-t deer	3,206	1,700	0	-108	- 85	- 84	- 72	- 99
Black bear	187	144	0	-2	-1	-1	-1	-1
Otter	75	66	0	-1	-1	-1	-1	-1
Marten	160	144	0	-17	-13	-11	-12	-14
Hairy woodpecker	1,470	1,051	0	-177	-132	-118	-130	-142
Van.Can.goose	269	243	0	-24	-17	-16	-19	-19
Bald eagle	233	137	0	-2	-1	-1	-1	-1
Brown creeper	3,526	1,338	0	-207	-146	-133	-141	-160
Red squirrel	76,774	70,793	0	-7,579	-7,158	-7,043	-7,166	-7,253
Grey wolf	8	4	0	0	0	0	0	0

SOURCE: Matson, 1993
Note: Numbers do not incorporate patch size effectiveness calculations (see the Old-Growth/Biodiversity section)

Forest fragmentation represents a change in the overall forest landscape from large, contiguous blocks of old-growth forest to smaller blocks separated by timber harvest units. Increased amounts of forest fragmentation indicate reduced habitat potential for species which are thought to be dependent on interior old-growth forest habitat. One way to analyze forest fragmentation is to measure the reduction of large, contiguous blocks of old-growth forest as a result of timber harvest. Extremely large blocks of old growth (Cleveland peninsula, Misty Fiords National Monument, and the Naha Roadless Area) are adjacent to the Project Area. The Orchard Lake area contains high volume old growth that is not scheduled for harvest under any alternative. In addition, the Project Area contains a significant amount of old-growth habitat in blocks over 10,000 acres in size. Table 2-10 shows the number of acres of old-growth habitat in large blocks that will remain after implementation of an alternative.

Table 2-10
Effect of Timber Harvest on Forest Fragmentation, in Acres

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Acres of lg., unfragmented blocks >1,000 acres remaining after harvest	3,460	8,625	9,353	10,154	7,463	10,118
Acres of lg., unfragmented blocks >10,000 acres remaining after harvest	49,505	31,184	34,716	33,241	34,585	32,997
Total Acres of Old Growth remaining after harvest	56,927	48,695	51,193	51,156	50,503	50,359

SOURCE: Matson, Nightingale, 1993

Issue 5. Subsistence Use

Chapter 3 evaluates the potential site-specific effects on subsistence that could result from implementing any of the proposed timber harvest and associated road construction alternatives.

The Tongass Resource Use Cooperative Survey (TRUCS) identified areas which are most heavily used by subsistence households. Based on the TRUCS, the Project Area contains no high or moderate use subsistence areas.

Deer hunting is one aspect of subsistence use affected by timber harvest. The Wildlife and Subsistence sections of Chapter 3 discuss the computer models used to estimate the effects of timber harvest on deer habitat capability—both long range and short range. Based on this analysis, Alternatives 1 will cause no reduction of deer habitat capability. Among the action alternatives, Alternative 5 would cause the least reduction to deer habitat capabilities (72), while Alternative 2 would reduce deer habitat capabilities the most severely (109) within the Project Area.

Table 2-11 displays the number of deer the habitat in the WAA's (509 & 510) can support now and at the end of the KPC Long Term Sale (2004). The full WAA habitat capability has not been reduced for the effects of fragmentation.

Table 2-11
Deer Harvest and Habitat Capability for WAA 509 & 510

Alternative	Habitat Capability Index 1997	Habitat Capability Index 2004	Population of Deer Needed to Meet Demand 1993
1	3,332	3,223	970
2	3,223	3,223	970
3	3,247	3,223	970
4	3,248	3,223	970
5	3,260	3,223	970
6	3,233	3,223	970

SOURCE: Matson, 1993
Note: Habitat capability for entire WAA's has not been reduced for fragmentation

The Project Area is located within portions of two wildlife Analysis Areas (WAA), 509 and 510. The harvest is 100 deer per year based on ADF&G hunter surveys for both complete WAA's. Approximately 970 deer are needed to support this level of deer harvest. Currently (1993) the two full WAA's provide habitat capability for 3,332 deer. The habitat capability through the year 2004 is projected to be 3,223 deer.

The analysis would indicate that none of the alternatives will cause a significant restriction of subsistence hunting or fishing at this time. However, based on the potential indirect and cumulative effects of timber harvest (due to a downward trend in habitat capability), there may be a significant possibility of a significant restriction of subsistence use of deer and some furbearers within the Project Area for all alternatives in the future.

Issue 6: Social and Economic Effects

The State of Alaska receives 25 percent of the sum of all net receipts from timber sold on National Forest System Lands plus any purchaser road credits. This money is earmarked for public school and road maintenance funding. Table 2-12 shows the estimated returns to the State of Alaska and the Ketchikan Gateway Borough from the harvest of timber (from this project only) by alternative. Actual returns will be based upon scaled volumes and appraised rates and may differ from this estimate, which is based on mid-market rates.

Table 2-12
Average Annual Returns to State of Alaska from Sale of Timber*

Alternative	Estimated volume (MMBF)	Total receipts (M$)	State of Alaska returns (M$)	Ketchikan (KGB) returns ** (M$)
1	0	0	0	0
2	63	5,969	1,492	67
3	44	5,048	1,262	57
4	45	4,094	1,024	46
5	48	4,975	1,243	56
6	49	5,046	1,261	57

SOURCE: Somrak, 1992
* Based on mid-market rates and four year harvest rate (see Appendix A)
**Based on historical average percent distribution.

Table 2-13 displays the employment (jobs) and personal income (salaries) associated with each alternative averaged over a four-year period. The jobs and salaries listed include those both directly and indirectly dependent upon the timber industry.

Table 2-13
Timber Industry Average Annual Employment and Income (by Alternative)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Volume Harvested						
Total (MMBF)	0	251	174	178	193	198
4 Year Avg (MMBF)	0	63	44	45	48	49
Employment (Jobs)	0	579	345	405	450	448
Personal Income (Millions $)	0	17.5	11.9	12.2	13.6	13.5

SOURCE: Somrak, 1992

All Alternatives provide sufficient volume, in combination with other scheduled offerings, to meet contractual obligations to KPC and assist in maintaining timber-related employment in the region. In these alternatives, the total volume harvested ranges from 174 MMBF in Alternative 3 to 251 MMBF in Alternative 2. Alternatives 4, 5 and 6 provide 178 MMBF, 193 MMBF and 198 MMBF respectively. These volumes would be provided to KPC in harvest offerings that would meet contract requirements and maintain the volume needed to continue production.

Under Alternative 1, the no-action alternative, none of the employment described above would be supported by timber harvest activity in the North Revilla Project

Area. This would result in a negative effect on local timber harvest employment should KPC not be able to substitute volume from another source. The effects of Alternative 1 are not predictable and could range from elimination of shifts to partial or even full shutdown of the KPC mill for an unspecified period of time. Selection of the no-action alternative could also have potential long-term ramifications to the contract holder, the core communities, and ultimately Southeast Alaska, through de-stabilization of the wood products industry. The projected long-term effects of different harvest levels are contained in the TLMP Revision Supplement to the Draft EIS (TLMP Draft Revision, 1991a).

None of the alternatives is expected to have a significant direct impact on the commercial fishing, recreation, and tourism industry, or related employment.

Issue 7: Marine Environment

Direct effects to the marine environment are assumed to occur only from development and use of LTF's, and are limited to the intertidal area affected by rock fill, and either the intertidal or subtidal areas potentially affected by accumulations of bark debris.

A total of 24 potential LTF locations were considered for possible development. There are 11 existing LTF sites and 13 potential new sites. The maximum number of LTF's that would be utilized under any alternative is 7 (1 new site and 6 existing sites), as there are 2 or 3 possible sites considered for each road system. The final selection of which LTF sites to utilize was based on the interagency guidelines (Alaska Log Transfer Facility Siting, Construction, Operation, and Monitoring/Reporting Guidelines). The U.S. Fish and Wildlife Service and the National Marine Fisheries Service staff conducted subtidal surveys at the sites that appeared to best meet the interancy guidelines. The subtidal survey reports and recommendations which are included as part of Appendix G, were used to further define which of the potential LTF locations was preferable. Table 2-14 displays the LTF's involved in the various alternatives. See also the detailed alternative maps included with North Revilla EIS.

Table 2-14
Log Transfer Facilities Required (by Alternative and System)

LTF Name	LTF Number	Alternative 1	2	3	4	5	6	LTF System
Hassler Island	2	N	I	I	I	I	I	A Frame
Klu Bay	4	N	I	I	I	I	I	A Frame
Shrimp Bay	5	N	I	I	I	I	I	A Frame
Chin Point*	7	N	I	I	I	I	I	Low Angle Ramp
Fire Cove	16	N	I	I	I	I	I	A Frame
SW Neets	17	N	I	I	N	I	I	A Frame
Margaret Bay	24	N	I	I	I	I	I	A Frame

SOURCE: Rhodes, 1993
I = Planned for intermittent use; N = Not planned for use. * New Log Transfer Facilities

Table 2-15 displays the number of LTF's used or developed, the total acreage of the structural embankment, and the estimated acres to be affected by bark deposition. The combination of the marine habitat covered by the structural embankment and the area potentially covered by bark deposition represents the total loss of marine benthic habitat for each alternative.

Table 2-15
Marine Benthic Habitat Affected (by Alternative)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Number of Sites	6	7	7	6	7	7
Structural Embankment (Acres Affected)	1.4	1.6	1.6	1.4	1.6	1.6
Bark Deposition (Acres Affected)	0	7.0	7.0	6.0	7.0	7.0
Total Acres of Marine Benthic Habitat Affected	1.4	8.6	8.6	7.4	8.6	8.6

SOURCE: Rhodes, 1993

The no-action alternative has no additional effect on the marine environment, while alternatives 2, 3, 5, and 6 affect the marine system (8.6 acres) in a similar fashion, followed by Alternative 4 (7.4 acres). The loss of habitat is much less than one percent of the available marine habitat in the Project Area. Since all species identified along the subtidal (underwater) survey transects are common throughout Southeast Alaska, it is concluded that there would not be a significant impact to the marine environment from constructing (or continuing to use) LTF's at the proposed sites.

Comparison of Alternatives by Environmental Consequences

Table 2-16 displays a summary comparison of the anticipated consequences of each of the alternatives over the entire Project Area. It is presented by resource as in Chapter Three.

Table 2-16
Comparison of Environmental Consequences by Alternative (in percent)

Environmental Consequence	Alternative 1	2	3	4	5	6
Timber (Stages)						
Seedling/Sapling	14	25	21	21	22	22
Poletimber	9	9	9	9	9	9
Mature Sawtimber	1	1	1	1	1	1
Old-growth	76	65	69	69	68	68
Floodplains						
% of total affected	0	7	9	4	14	9
Wetlands						
% of total affected	0	6	3	3	4	3
Beach Fringe						
% of total affected	0	<1	<1	<1	<1	<1
Estuary Fringe						
% of total affected	0	<1	<1	<1	<1	<1
Riparian (AHMU)						
% of total affected	0	4	3	3	3	4
Old-growth Forest						
% of total affected	0	14	10	10	11	12
Alpine/Subalpine						
% of total affected	0	1	<1	<1	<1	<1
Wildlife MIS Habitat Decrease in % from 1993						
Black Tailed Deer	0	6	5	5	4	6
Black Bear	0	1	<1	<1	1	1
Marten	0	12	9	8	8	10
Otter	0	2	2	2	2	2
Hairy Woodpecker	0	17	13	11	12	14
V.Canada Goose	0	10	7	7	8	8
Bald Eagle	0	1	<1	<1	<1	<1
Brown Creeper	0	15	11	10	11	12
Red Squirrel	0	11	10	10	10	10

— more —

Table 2-16 — (continued)
Comparison of Environmental Consequences by Alternative (in percent)

Environmental Consequence	Alternative 1	2	3	4	5	6
Subsistence						
Significant possibility of a significant restriction						
Deer	no	no	no	no	no	no
Bear	no	no	no	no	no	no
Furbearers	no	no	no	no	no	no
Salmon	no	no	no	no	no	no
Other finfish	no	no	no	no	no	no
Waterfowl	no	no	no	no	no	no
Marine mammals	no	no	no	no	no	no
Indirect & Cumulative Effect of Harvest	no	may	may	may	may	may
Watershed and Fish Stream Crossings						
% of TTRA Buffer	0	<1	<1	<1	<1	<1
Fish MIS Habitat						
% of total affected						
Coho Salmon	0	<1	<1	<1	<1	<1
Pink Salmon	0	0	0	0	0	0
Dolly Varden	0	<1	<1	<1	<1	<1
Recreation						
Decrease in % of Project Area in Primitive and Semi-primitive Non-motorized ROS	0	13	7	11	10	8
Visual Quality						
% increase in Cumulative Visual Disturbance (CVD)						
Behm/Indian Pt	0	0	0	0	0	0
Behm/Traitors	0	2	3	3	5	3
Traitors Cove	0	16	17	5	9	17
Margaret Cove	0	21	12	8	9	9
Inner Traitors	0	7	6	4	4	6
SW Neets Bay	0	1	3	0	2	4
NW Neets Bay	0	11	10	9	5	10
Inner Neets Bay	0	5	5	7	7	7
Hd of Neets Bay	0	10	6	11	11	6

— more —

Table 2-16 — (continued)
Comparison of Environmental Consequences by Alternative (in percent)

Environmental Consequence	Alternative 1	2	3	4	5	6
Behm/Gedney Pass	0	5	2	8	0	5
Shrimp Bay	0	5	0	8	2	4
Klu Bay	0	12	7	10	8	11
Behm/W. Hassler	0	7	9	7	2	10
Behm/N. Hassler	0	13	11	17	10	12
S.Hassler Pass	0	15	11	12	6	11
Orchard Lake	0	0	0	0	0	0
Marine Habitat						
Total Acres Impacted	0	8.6	8.6	7.4	8.6	8.6
% of Marine Habitat	0	<1	<1	<1	<1	<1
Land Status						
Acres within a Land Selection	0	0	0	0	0	0
Roads in Selection	No	No	No	No	No	No
Cultural Resources						
Impacts to known cultural resources	0	0	0	0	0	0
Economic & Social (4 YR/AVG)						
Employment	0	568	395	405	450	448
Income ($millions)	0	6.98	5.04	5.54	5.68	5.68
Payment to State ($millions)	0	1.49	1.26	1.02	1.24	1.26
Payment to KGB ($thousands)	0	67	57	46	56	57

Sale Area Improvements and Other Opportunities

The interdisciplinary team has identified two general types of opportunities related to the proposed action. The first general opportunity identified relates to the Knutson-Vandenberg (KV) or Sale Area Improvement Plan opportunities that could be accomplished. The Knutson-Vandenberg Act allows the Forest Service to collect a portion of the available stumpage to perform reforestation and sale area improvements during and up to five years after the sale is completed. The second type of opportunity identified is the amount of road construction or reconstruction that would occur along that portion of the utility corridor route [(TLMP Draft Revision, 1991a) & (R.W. Beck, 1990)] located within the study area.

Sale Area Improvements - KV Treatments

This section identifies specific post-harvest silvicultural treatments expected to occur in the North Revilla Project Area after timber harvest activities are completed. KV treatments are subdivided into four generalized categories, including: (1) essential reforestation, (2) mitigation, (3) maintenance of productivity, and (4) improvements. Essential reforestation will be will be done using KV funds. Categories (2), (3), and

(4) could be done using KV funds if available. If KV funding is not available, then program management (appropriated) funds could be used.

KV Essential Reforestation

Table 2-17 displays an estimate of the essential reforestation activities proposed for each alternative to maintain current species composition or to meet National Forest Management Act (NFMA) requirements for adequate stocking. Planting of Alaska yellowcedar is proposed for the majority of this acreage to maintain tree species diversity and wildlife habitat diversity.

Table 2-17
Alternative 2 - Essential Reforestation Treatments (in acres)

Alternative	Site Prep	Tree Plant	Plant Survey	Release & Weed	Regen Surveys	Cone Collection
1	0	0	0	0	0	0
2	154	356	356	457	7,876	11 (bushels)
3	160	495	495	304	5,239	.11
4	139	344	344	335	5,576	11
5	142	480	480	358	5,944	11
6	125	453	453	358	6,115	11

SOURCE: Nightingale, 1993

KV Mitigation

Under all alternatives up to 30 acres of potential debris slide rehabilitation and stabilization, as well as monitoring could potentially be accomplished. The grass seeding of up to 50 acres of selected roadbeds is prescribed to help offset overall wildlife forage reductions due to harvest, help minimize sedimentation, and delay alder regrowth.

KV Maintenance

Precommercial thinning to maintain wildlife habitat capability or enhance riparian habitat is projected for the areas listed below in Table 2-18 and Table 2-19. Precommercial thinning will delay crown closure and ultimately prolong the existence of understory vegetation by allowing sunlight to continue to reach the forest floor. It is also part of a long-term prescription that will yield increased windfirmness, structural diversity and recruitment snags at an earlier age.

Table 2-18 lists the high priority sites for wildlife/fisheries thinning. These sites are existing second-growth timber that will be 12 to 18 years old during the period when KV expenditures will be appropriate. These stands are located on south or west facing slopes below 800 feet in elevation (critical deer winter range) or are adjacent to travel corridors or riparian zones. For a detailed listing of the recommended high priority wildlife thinning sites see Appendix I.

Table 2-18
Wildlife Precommercial Thinning — Critical Deer Winter Range

VCU	Acres
732	0
733	12
735	0
736	137
737	0
738	0
739	166
740	0
Total	315

SOURCE: Nightingale, 1993

Table 2-19 lists the medium priority sites for wildlife thinning. These sites are existing second-growth timber that will be 12 to 18 years old during the period when KV expenditures will be appropriate. These stands are located on south or west facing slopes below 1,500 feet in elevation or selected low elevation sites on north and east aspects (important deer winter range). For a detailed listing of the recommended medium priority wildlife thinning sites see Appendix I.

Table 2-19
Wildlife Precommercial Thinning — Important Deer Winter Range

VCU	Acres
732	0
733	233
735	0
736	204
737	71
738	37
739	1,065
740	0
Total	1,610

SOURCE: Nightingale, 1993

Precommercial thinning to maintain timber productivity is projected for the areas listed below in Table 2-20. Existing second-growth stands within the Project Area suffer from excessive competition for light because of the large number of young trees that become established after clearcutting. Hemlock and spruce are shade tolerant, the young stands have low mortality rates and trees do not express strong dominance in the first half of a rotation. Natural thinning through competition occurs late in the stands life. Precommercial thinning existing second growth stands between the age of 15 and 20 years will result in larger diameter trees, increase sawlog yields by 10-12 percent, and improve windfirmness which is critical if harvest methods other than clearcutting are to be employed in the future management regime. A detailed listing of the stands recommended for treatment using KV funds in included in Appendix I.

Table 2-20
Timber Precommercial Thinning - Maintain Productivity

VCU	Acres
732	0
733	48
735	117
736	305
737	208
738	136
739	896
740	0
Total	1,710

SOURCE: Nightingale, 1992

KV Improvements

The following enhancement opportunities identified for the action alternatives may require further analysis and disclosure per NEPA and Forest Service requirements before their implementation.

The Margaret Creek fish pass was constructed using KV funds in 1989. Enhancement and monitoring efforts are needed to determine the effects on resident fish and salmon production related to the fish pass. Detailed monitoring has occured in 1990 and 1991. Continued monitoring could be funded through KV funds collected as part of this project.

A Margaret Creek fish pass and trail interpretive sign to explain the life cycles of the different salmon species would be mounted at the fish pass viewing platform.

Stream rehabilitation opportunities exist on Class I streams that have been previously harvested in Neets Bay, and Traitors Creek.

Utility Corridor

The Tongass Land Management Plan Revision team has mapped the transportation and utility corridors on the Tongass National Forest. The maps show two corridors passing through the Project Area. The Alaska Legislature passed Senate Joint Resolution 40 during the 1992 session. This resolution urges the Forest Service to avoid actions which would preclude the use of any of the transportation and utility corridors identified by an interagency group.

The North Revilla Project Area contains a small portion of the two routes identified near Orchard Lake. The IDT reviewed the possibilities of action being taken on the transportation and utility corridors in the foreseeable future. The review indicated that the corridor could be used for electrical transmission lines within the next decade. The review concluded that the road connections proposed are unlikely within the forseeable future and that no actions proposed under any alternative would preclude use of any of the transportation and utility corridors.

The "Lake Tyee to Swan Lake Transmission Intertie" (R.W. Beck and Assoc., 1992) presents a feasible electric power transmission line route within the Project Area. The preferred route identified in the R.W. Beck study passes through the Project Area by way of Neets Creek and Klam Creek drainages (Figure 2-11).

The Ketchikan Gateway Burough and the Alaska Department of Transportation and Public Facilities cooperated in an examination of highway corridor opportunities. This study, *Ketchikan - Revillagigedo Island Corridor Study* (R&M Engineering, 1992), identified a preferred highway route that passes through the Project Area on the north side of Orchard Lake and through Klam Creek. On the basis of aerial reconnaissance and examination of high resolution contour maps, the Ketchikan Area staff has also done preliminary identification of an alternative route that parallels the electric transmission route to Shrimp Bay. This alternative route uses a ferry terminal at Shrimp Bay as an alternative to the route on the north side of Orchard Lake and some very difficult highway building terrain north of Shrimp Bay.

The IDT considered these routes and evaluated them for likelihood of construction within the foreseeable future. For purposes of the evaluation, foreseeable future was considered to be the life of the Tongass Land Management Plan Revision (10–15 years).

The electrical transmission line was examined in light of overall mission of the effort, history of funding of such projects, and difficulty of accomplishment. By comparison to other power transmission projects within Alaska and possible funding, the IDT concluded that the construction of the power line was likely within the foreseeable future.

The effects of the possible construction of the power line within the Project Area have primary effects on the visual resource. The clearing of the corridor along the transmission lines can be seen from a number of view points.

The actions proposed in the Project Area could benefit the transmission project by incidental transportation and logistics uses. The construction of the transmission across National Forest lands normally requires removal of all merchantable timber felled along the corridor. The road system will allow shorter flights for helicopters removing the timber, reducing costs. The roads will also allow shorter transportation by helicopter for towers, cable, and other logistics. This is expected to result in a reduction of costs. Table 2-21 displays the miles of road that would be constructed or

reconstructed that could potentially serve as access to a possible utility corridor route within the Project Area under each alternative.

Table 2-21
Potential Utility Corridor Access Miles

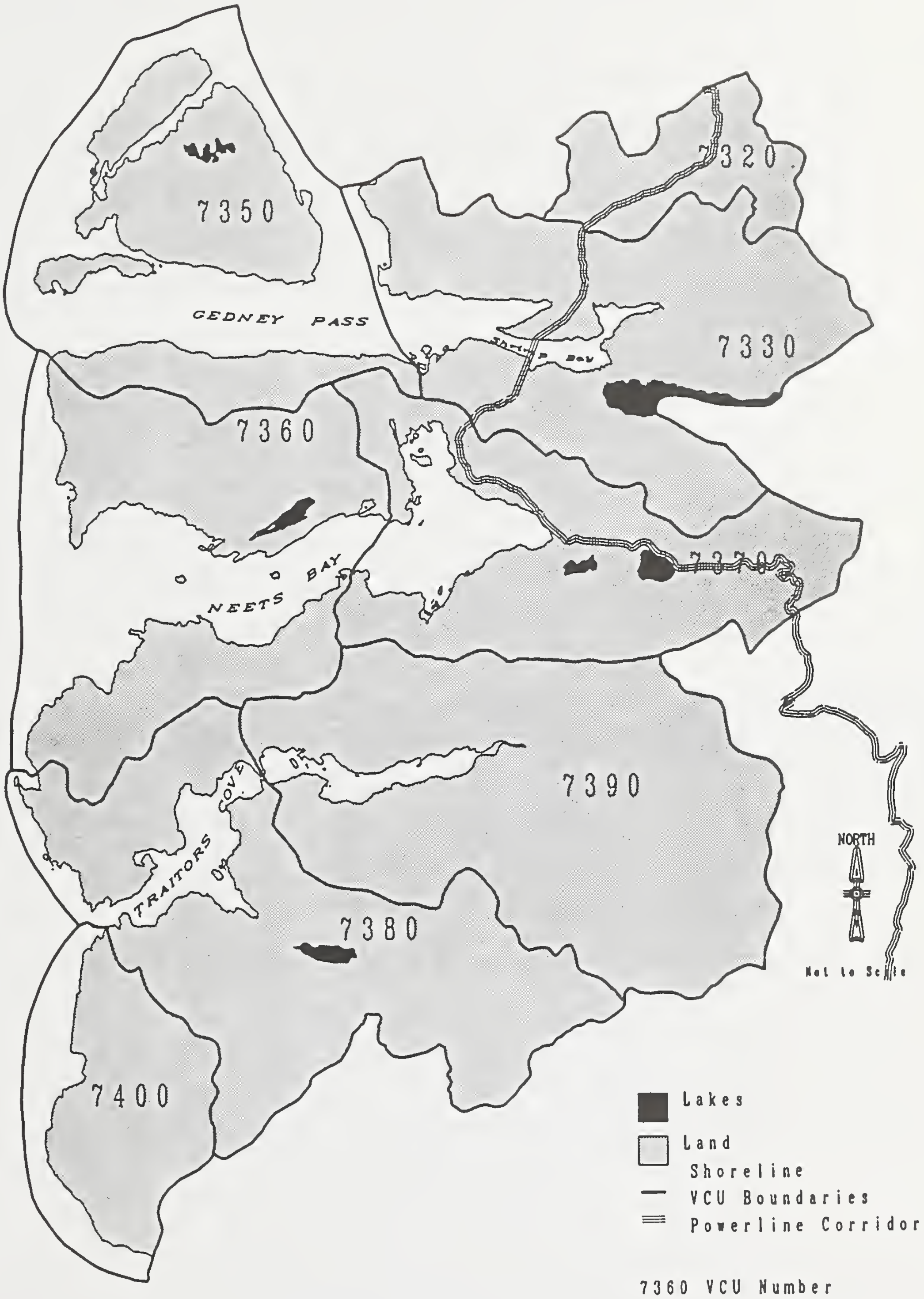
Alternative	Miles
1	0
2	12.3
3	0.8
4	8.3
5	12.1
6	0.8

SOURCE: Rhodes, 1993

The IDT examined the highway corridors using the history of highway development on Prince of Wales Island as a model. The team also evaluated the history of development of highway corridors between communities elsewhere in Southeast Alaska, and the history associated with construction of roads through LUD II designated lands under the Tongass Land Management Plan, as well as the probable direction of construction along the corridor (Ketchikan northward, Beam Canal southward, or sections in the middle). The IDT concluded that the most likely direction of construction was from Ketchikan northward. Using the rate of progress of state highway development on Prince of Wales Island, the road construction would not reach the Project Area within the foreseeable future. The IDT also noted that the Forest Supervisor has made a determination that the construction of a road from Ketchikan to Shelter Cove was not in the foreseeable future.

The IDT evaluated the action alternatives as requested by Senate Joint Resolution 40, and determined that none of the action alternatives will preclude the identified transportation and utility corridors within the foreseeable future.

Figure 2-11
Proposed Utility Corridor



Mitigation Measures

The Forest Service uses numerous mitigation and preventive measures in the planning and implementation of land management activities. The application of these measures begins during the planning and design phases of a project. They link to the overall Forest, Ketchikan Administrative Area, and Ranger District management direction and continue through all phases of subsequent forest management. The Standards, guidelines, and direction contained in the current TLMP (1979a), the Supplement to the Draft EIS for the TLMP Revision (1991), Alaska Regional Guide, and applicable Forest Service manuals and handbooks have been applied in the development of alternatives and design of harvest units and roads.

Public comment on the North Revilla DEIS was helpful in identifying when and where additional mitigation measures should be considered. Listed below is a brief summary of some of the mitigation measures common to all alternatives. Specific mitigation measures, as applied to each individual unit, can be seen in the "As Planned" Unit Layout and Road Cards. These unit and road cards are an important tool for implementing the project, as they list standards and guidelines and provide a mechanism for tracking project implementation. Unit and road cards have been developed for each individual unit that occurs in an alternative, and appear in Appendix K.

Water Quality and Fish Production

Mitigation to protect water quality, fish habitat, and wetlands includes application of the Best Management Practices (BMP's) stated in the Soil and Water Conservation Handbook (USDA FSH 2509.22). This handbook provides standard operating procedures for all stream classes. In addition, the TTRA mandates a *minimum* 100-foot buffer on all Class I streams and on Class II streams that flow directly into Class I streams. The width of this buffer strip may be *greater* than 100 feet for reasons such as topography, riparian soils, a windfirm boundary, timber stand boundaries, logging system requirements, and varying stream channel locations. In addition, certain Class III streams flow directly into or have been identified as influencing Class I streams. These Class III streams have been buffered to the slope break of the channel or to a windfirm boundary to protect water quality. Split yarding or full suspension was built into the logging and transportation design process, as was partial and full suspension over wetlands soils with a higher mass movement potential. Direct in-stream impacts are minimized through road construction timing and fish passage requirements on certain Class I and II streams. Refer to Appendix K (Unit and Road Cards) for the unit-specific stream buffering, suspension, passage, and timing requirements being applied. Application of BMP's and adherence to the TTRA requirements will protect water quality fish habitat and wetlands as well as riparian habitat important to other species such as deer, bear, and furbearers.

While required TTRA buffers will mitigate most temperature sensitivity concerns, there still is concern about providing topographic shading to Class III streams that flow through harvest units. Table 2-22 lists units and groups of units that have characteristics (south aspect, lack of immediate downstream forested stream buffers, historical and continued harvest activities, etc.) that may contribute to the

temperature sensitivity of nearby streams were identified by the IDT. To mitigate this possible effect, all deciduous trees and conifer trees less than 12 inches DBH within 35 feet of Class III streams, will remain standing in these units.

Table 2-22
Units Having Buffers for Temperature Sensitivity

Units	Alternative(s)				
3004	2				
3006	2	3	4		6
3007	2		4	5	6
3015	2				
3016		3			6
3021		3			6
3022		3			
3035			4	5	
3037			4		
4007			4	5	
6026		3			
8046	2			5	
8057		3			6
8062		3			

SOURCE: Zellmer 1993

Wildlife

Mitigation measures to protect wildlife habitat are a part of the design of the alternatives, including the location of the harvest units and roads. Harvest units and roads are intentionally located away from important wildlife habitats (to the extent practicable) to reduce the effects on wildlife. Beach and estuary habitats are completely avoided by harvest units, while road incursions are minimized to the extent practicable. Where possible, disturbance of important travel corridors is minimized to allow the undisturbed movement of wildlife. Other specific mitigation measures include:

1. Provide for habitat requirements of cavity and snag dependent Management Indicator Species (MIS) by leaving 275 snags per 100 acres averaged over each VCU. To provide for adequate distribution of snags within VCU's which have marginal numbers of snags, the following units will have small 0.1-acre (or larger) snag patches distributed throughout the unit at a rate of 0.1 acre per 10 acres of unit. The location of these snag patches will be determined during layout or sale administration, and will be designed in such a fashion as to not impose undue safety hazards on logging contractors.

   Guidelines for placement of snag patches and old-growth islands include:

   a. Areas where wildlife use is concentrated (determined during recon). .
   b. Selected areas should be at least 100 feet away from unit boundary (unless the unit boundary is an existing second-growth stand; then the patch or island can be placed along the unit boundary).

c. Patches or islands can be placed along split yard sections of harvest units, particularly split yard streams.
d. Snag patches or old-growth islands can be incorporated into stream buffers.
e. Snag patches or old-growth islands can be placed along boundaries of muskegs.

Units which will employ these snag recruitment techniques include:

3021	3037	6008
6011	6024	6049
7004	7009	7038
7086	8003	8009
8010	8017	8022
8041	9082	9091

2. Region 10 goshawk management guidelines in effect at the time of unit release will be followed. The interim guidelines issued August 18, 1992, call for no harvest within the immediate timber stand (20–30 acres) containing an identified nest tree, limited harvest (five percent per decade) within the adjacent 600 acres (post-fledging area), and mapping out approximately 6,000 acres for the foraging area.

   Any new nests discovered during field recon or unit layout will be protected from timber harvest and blowdown by a minimum 660-foot buffer around the nest tree.

3. Due to the limited information available on nesting habitat requirements of marbled murrelets, any nests located during field recon or unit layout will be assessed on a case-by-case basis.

4. Timber harvest units that are within a half mile of Margaret, Bluff, Elizabeth and Orchard lakes, the upper end of Margaret Bay and Traitors Cove Salt Chuck, and Neets and Klu Bay will have harvest and road construction activities limited to the time period when trumpeter swans are not present (normally from April 1 to October 31). This affects the following units:

3005	3006	3010
3012	3016	3037
8001	8009	8011
8070	8071	9000
9008	9041	9047
9048	9053	9056
9103		

5. Road construction activities that are within a half mile of bald eagle nests will usually have blasting restricted to the period of September 1 to February 28. If the nest is unoccupied, normal blasting procedures are also permitted from June 1 to August 31 if there is no direct danger to eagles, nests, eagle nest trees, or other eagle habitat elements. Blasting within 1/2 mile of an active eagle nest is only allowed if 1) the blasting can be accomplished in accordance with the requirements of the Bald Eagle Protection Act; 2) written coordination with the U.S. Fish and Wildlife Service has occurred; 3) the results of the interagency coordination is documented. Road construction to harvest units that may have blasting restricted to certain time periods are listed in Appendix K.

6. The following Forest-wide standards and guidelines have been developed for application on all Forest Service permitted or approved activities and have been incorporated by reference into the North Revilla Final EIS from the Supplement DEIS Tongass Land Management Plan (1991a):

   Provide for the protection and maintenance of whale habitats:
   a. Avoid intentional aircraft flights below 500 feet above ground level in the known vicinity of whales on Forest Service permitted or approved activities, when weather ceilings permit.
   b. Avoid intentional approach in a vessel of 100 feet or more in length to within 1/4 mile of whales on Forest Service permitted or approved activities, when safe passage exists.
   c. Avoid intentional approach in a vessel of less than 100 feet in length to within 100 yards of whales on Forest Service permitted or approved activities, when safe passage exists.

7. Forest-wide standards and guidelines direct the Forest Service to prevent and/or reduce potential harassment of sea lions and other marine mammals due to activities carried out by or under the jurisdiction of the Forest Service, and these have been incorporated by reference into the North Revilla Final EIS from the Supplement DEIS Tongass Land Management Plan (1991a). These Forest-wide standards and guidelines are as follows:

   Provide for the protection and maintenance of harbor seal, Steller sea lion, and sea otter habitats.
   a. Ensure that Forest Service permitted or approved activities are conducted in a manner consistent with the Marine Mammal Protection Act and the Endangered Species Act. 'Taking' of marine mammals is prohibited; taking includes harassment, pursuit, or attempting any such activity.
   b. Locate facilities and concentrated human activities requiring Forest Service approval as far from known marine mammal haulouts, rookeries and known concentration areas as practicable. The following distances are provided as general guidelines for maintaining habitats and reducing human disturbance:
      * Facilities, camps, LTF's, campgrounds and other developments should be located 1 mile from known haulouts, and farther if the development is large.
      * For aircraft flights on Forest Service approved projects, when weather ceilings permit, maintain a constant flight direction and airspeed and a minimum flight elevation of 1,000 feet (305 meters) within .5 miles (800 meters) of the haulouts.
      * For boat traffic on Forest Service approved projects, remain at least .5 miles (800 meters) away from hauled-out harbor seals during the pupping and rearing season (15 May–1 July). Minimize disturbance of seals with pups in the water by remaining at least 330 feet (100 meters) away from parturient seals. (*Note:* These distances are derived from a study in a park where hunting is prohibited and access is restricted and where viewing seals is encouraged. These distances may be too liberal and may need to be enlarged in situations where access and hunting are not controlled and where seals would be expected to be more reactive to boat traffic.)
      * Minimize disturbance effects of boat traffic: for molting harbor seals, remain .5 miles (800 meters) away from haulouts where seals are molting; for Steller sea lions, remain at least .5 miles (800 meters) away from haulouts and rookeries; for sea otters, avoid known feeding and

resting concentration areas, especially following prolonged stormy periods when sea otters have been unable to feed.

* Individuals associated with Forest Service permitted or approved activities will not intentionally approach within 100 yards, or otherwise intentionally disturb or displace any hauled-out marine mammal.

Several harbor seal haulout areas have been identified in the Project Area. They include:

- a rock at entrance to Traitors Cove
- islands and rocks in Traitors Cove salt chuck
- Bug Island in Neets Bay
- Clam Island is Neets Bay
- Fire Cove Neets Bay
- rocks north side of Neets Bay
- island in north bay of Neets Bay
- a rock within salt chuck north side of Neets Bay
- rocky shoreline of Gedney Island
- rocks off east tip of Gedney Island
- rocks off Fin Point of Hassler Island
- Shrimp Bay cove
- rocks off southern tip of Block Island and in Blind Pass.

Forest-wide Standards and Guidelines have been developed to provide for the protection and maintenance of harbor seal habitats (TLMP Revision 1991a page 4-102). These guidelines will be followed, except where safe passage does not exist beyond the recommended distances.

Due to the fact that safe passage does not exist outside of the recommended TLMP Revision (1991a) guidelines, the following project standards and guidelines will be implemented for Forest Service permitted and administrative activities with the following limitations for the pupping and haulout areas listed below:

- *rock at entrance to Traitors Cove* The Margaret LTF and camp may be operational during pupping and rearing season (April 15 - July 1). The distance between the rock and shore is less than one mile with no other safe passage for boat traffic. A 330-foot boat distance from the island will be maintained to minimize disturbance, rather than the 0.5 mile distance specified by TLMP as desirable. Aircraft from Margaret Bay will achieve as high an altitude above the rocks as weather and safe conditions permit.

- *islands and rocks in Traitors Cove salt chuck* A shoreline buffer of 500 feet will mitigate any land based activities from disturbing haul out and pupping areas.

- *Bug and Clam islands in Neets Bay* The LTF's and potential campsite may be operational during the pupping and rearing season (April 15 - July 1). The safe passage corridors are approximately .25 miles from Bug Island. The distance between the rock and shore is about .5 mile with no other safe passage for boat traffic or log rafts. A 330-foot distance from the island will be maintained to minimize disturbance, rather than the 0.5 mile specified by TLMP as desirable.

- *Fire Cove and Neets Bay* The LTF is approximately 0.5 mile from seal haul out areas. A 500-foot shoreline buffer will help reduce disturbance to the seals. The LTF has been permitted for use since 1975 with no practical alternatives found.

A 330-foot distance by boats from the haulouts will be maintained to minimize disturbance, rather than the 0.5 mile distance specified by TLMP as desirable.

8. Vancouver Canada goose habitat found during unit layout will be protected with a 410 foot buffer where management activities will be avoided, if possible, when the geese are present for nesting or brood rearing activities.

Subsistence

Because most subsistence use involves harvesting fish and game, mitigation measures that protect or enhance fish and game resources will also protect and enhance subsistence activities. By placing units and roads away from beach and estuary fringe habitats, and away from salmon bearing streams, mitigation measures were built into each of the alternatives considered in the EIS.

Recreation

Effects of timber harvest on views from anchorages and known recreational day use areas will be reduced by leaving buffers of timber along the beaches and inland lakes. The proposed visual quality objectives for this plan emphasize the protection of the visual resource as viewed from saltwater, and Hassler Island and Orchard Lake in particular will reduce the direct effects on visual quality. Stream RP buffers will protect fisheries habitat and sport anglers use of class I and II streams in the Project Area.

Cultural Resources

Potential effects on cultural resources can be minimized by excluding project activities from most high probability areas (exceptions are LTF's, camps, a small number of units, and access roads to these facilities). The high probability areas were all surveyed in 1992, except for exact road locations which cannot be precisely determined until after unit and road layout occurs. Types of mitigation measures include avoidance, protective enclosures, monitoring of harvest activities, restrictions on size or road location, and recovery and documentation of materials.

Monitoring

Monitoring activities can be divided into three broad categories: Forest Plan monitoring, routine implementation monitoring, and project-specific monitoring. These broad types are discussed in the following sections.

Forest Plan Monitoring

The National Forest Management Act requires that National Forests monitor and evaluate their forest plans (36 CFR 219.11). The significance of this requirement is emphasized by the recent development of a National Monitoring and Evaluation Strategy (Forest Service 1993). The Strategy is designed to focus agency attention and resources on evaluating implementation of forest plans to provide the Forest Service with information necessary to ensure responsive and efficient management of National

Forests. Embodied in the National Monitoring and Evaluation Strategy are three principles:

1. evaluation of results will be readily available to the public, agencies, and other groups;
2. monitoring and evaluation will focus on ecosystems and emphasize interrelationships among biotic and abiotic components; and
3. the strategy will be flexible to meet local needs while encompassing forest, regional and national requirements.

Three levels of monitoring are incorporated into Forest Plan monitoring and evaluation.

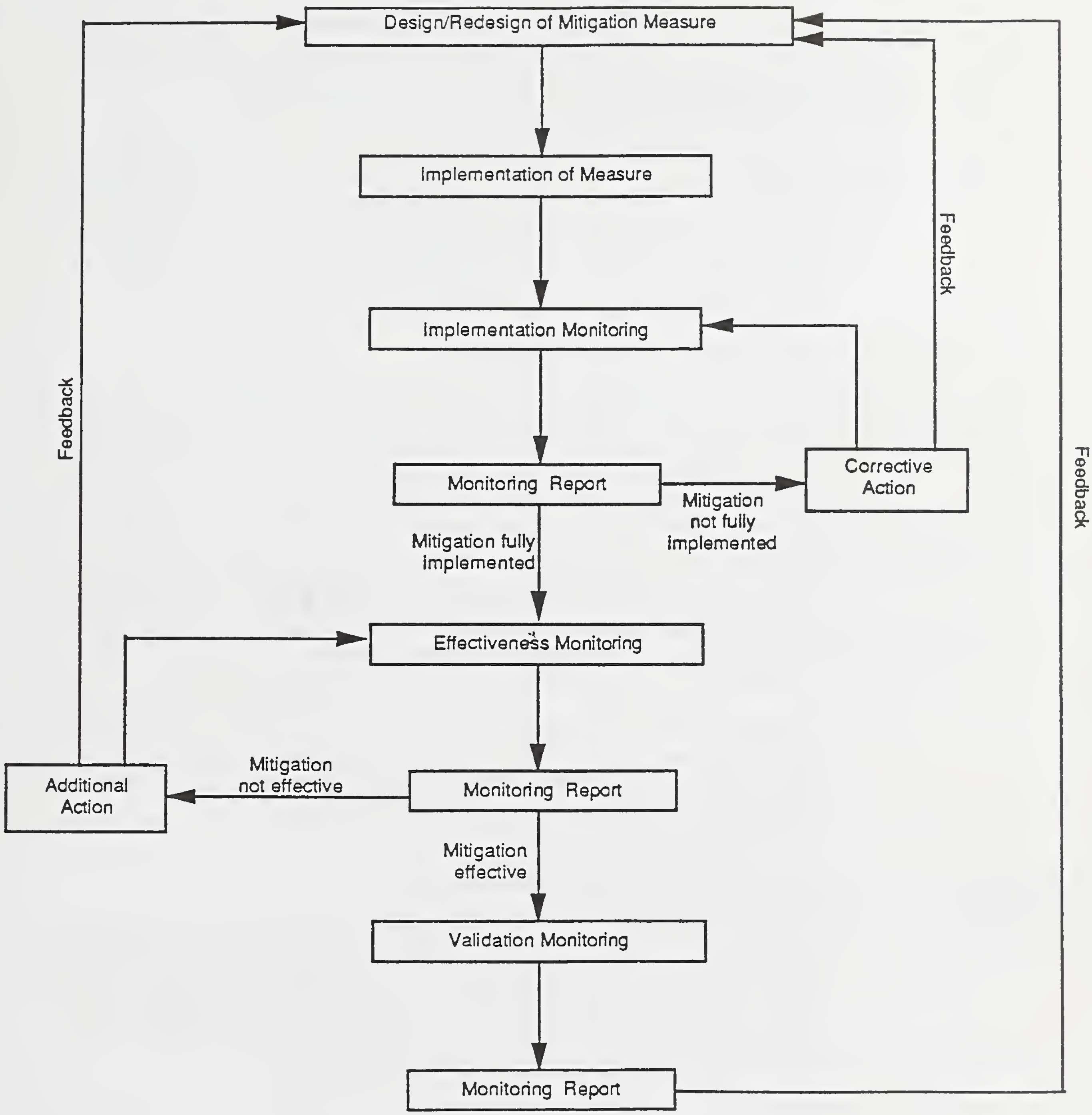
Implementation Monitoring is used to determine if goals, objectives, standards and guidelines, and management prescriptions are implemented as detailed in the Forest Plan and project specifications;

Effectiveness Monitoring is used to determine if goals, objectives, standards and guidelines, and management prescriptions as designed and implemented are effective in meeting Forest Plan goals and objectives; and

Validation Monitoring is used to determine whether the data, assumptions, and coefficients used in the development of the Plan are correct.

Most monitoring elements involve the mitigation measures described previously. The mitigation measures are part of a process that includes these three types of monitoring to determine if the measure was implemented and is effective or needs revision. The feedback provided by monitoring results can be used to develop improved methods or additional treatments to ensure that the mitigation will be effective in the future. Figure 2-12 displays how this process of mitigation and monitoring occurs.

Figure 2-12
Mitigation/Monitoring Feedback Loop



An annual monitoring report (Tongass NF, Ketchikan Area, Draft Monitoring Plan Fiscal Year 1994, dated 7/26/93)) will be prepared by each Administrative Area of the Tongass and incorporated into one report at the end of each year. This report will address all monitoring questions contained in the applicable Forest Plan; reference all monitoring being conducted on the Area/Forest; assess progress towards achieving the goals and objectives described in the Forest Plan; and either certify that the Forest Plan is sufficient to guide management of the Forest over the next year or propose needed changes and an approach for dealing with those changes.

Forest Plan monitoring is conducted over the entire Forest on a sample basis. Samples may or may not be taken within the North Revilla Project Area; however, monitoring results are designed to answer questions regarding the implementation and effectiveness of mitigation within the Project Area. A total of 38 implementation, effectiveness and validation monitoring items are identified in the forest-wide monitoring plan described in the TLMP Draft Revision (1991a). All monitoring is subject to funding and personnel limitations imposed upon the Agency.

Routine Implementation Monitoring

Routine implementation monitoring assesses whether the project was implemented as designed and whether or not it complies with the Forest Plan. Planning for routine implementation monitoring began with the preliminary design of harvest units and roads. Specialists used on-the-ground inventories, computer inventories, and aerial photographs to prepare the documents called unit cards for each harvest unit in each of the alternatives. Cards were also prepared for each segment of road. Resource specialists wrote their concerns on the cards and then described how the concerns could be addressed in the design of each unit and road segment. Resource concerns and mitigation measures will be refined further during final layout when specialists will have one more opportunity to revise the unit and road card recommendations. The unit and road cards documents will be the basis for determining whether recommendations were implemented for various aspects of the North Revilla Project.

Routine implementation monitoring is part of the administration of a timber sale contract. The sale administrators and road inspectors ensure that the prescriptions contained on the unit and road cards are incorporated into contract documents and then monitor performance relative to contract requirements.

Effectiveness Monitoring

Project-specific Effectiveness Monitoring

In addition to the Forest Plan monitoring and routine implementation monitoring that will be conducted throughout the Tongass National Forest, including the North Revilla Project Area, project-specific effectiveness monitoring activities are identified. Effectiveness monitoring seeks answers about the effectiveness of design features or mitigation measures in protecting natural resources and their beneficial uses. Monitoring records will be kept by the responsible staff.

Wildlife

Eagle Nesting Habitat
Objective: Monitor the use of the Hassler Island Bald eagle nest tree where USF&WS variance for road construction has been granted.
Desired Result: Protection of eagle nest locations.

Measurement: During management activities, observe nest use on nests #42 on Hassler Island.
Threshold: Management activities encroach on the 330-foot minimum buffer or when these activities cause eagle nesting to cease.
Corrective Action: If it appears eagle nesting activity is disrupted due to management activities, consult with ADF&G and USFWS to resolve potential problem.
Responsible Staff: KTN RD sale administrator and wildlife specialist.
Record of Results: Wildlife biologist or timber sale administrator will make observations during road construction activities. Checks will be recorded in a short memo documenting nest use.
Annual Cost: Ongoing activity for sale administration. Site visits by wildlife specialists would be $3,000 per year during active logging operations.
FTE Needs: 0.1 FTE.

Sensitive Species

Harbor Seals

Objective: To provide protection of specific habitats for this species which may be located in the North Revilla Project Area.
Desired Result: Minimal disturbance to marine mammal habitat located along the entrance of Traitors Cove and Traitors Cove salt chuck, Bug and Clam islands in Neets Cove, Fire Cove and Neets Cove. In addition, the North side of Neets Cove, Gedney and Hassler Islands, and Shrimp Bay.
Measurement: Visual observation of marine mammal use of the known haulout.
Threshold: Evidence that marine mammals use the haulout less frequently.
Corrective Action: Consult with ADF&G, USFWS, and NMFS for resolution if a conflict becomes apparent.
Responsible Staff: KTN RD wildlife staff.
Record of Results: Daily diaries used for contract administration. If a conflict arises, normal correspondence between agencies would record the conflict resolution.
Annual Cost: $2,500
FTE Needs: 0.1 FTE

Trumpeter Swan

Objective: Protect wintering Trumpeter Swans.
Desired Results: Preferred swan wintering areas on Orchard Lake, Margaret Lake and head of Traitors Cove will be protected from disturbance.
Measurement: Visual observation of wintering swans at least once when any timber harvest or road construction occurs within one mile of Orchard lake, Margaret Lake and the Head of Traitors Cove between November 1 and April 1.
Threshold: Evidence that swans are avoiding available habitat because of forest management activities.
Corrective Action: Consult Ketchikan District Ranger and SO wildlife staff if a conflict arises.
Responsible Staff: KTN RD sale administration employees and wildlife staff.
Record of Results: Sale administrator may record swan observations in daily diary forms. Wildlife specialists will prepare a short memo.
Annual Cost: Ongoing business for sale administrator and wildlife specialist.
FTE Needs: Zero

Fisheries

Temperature Sensitivity
Objective: To determine response of water temperature in potentially temperature sensitive hydrologic systems. Standards (WQS) for fresh water uses for the variety of land management activities conducted.
Desired Result: Attainment of State Water Quality Temperature Standards for the growth and propagation of fish, shellfish and other aquatic life and wildlife.
Measurement: State WQS criteria for temperature for fresh water uses. Criteria will be measured prior to, during and following project implementation. Monitoring will be implmented on the Traitors, Klam and Klu Creek systems.
Evaluation: Determine if Traitor's, Klam and Klu creeks meet criteria for State WQS's for fresh water uses. Determine if any deviation from WQS's can be correlated to BMP implementation and forest management activites. Report and feedback results into validation monitoring needs and redesign of BMP's.
Responsible Staff: KRD fisheries staff.
Report of Results: Inclusion of results in Ketchikan Area's annual post-season water quality report that summarizes Forest Service water quality monitoring efforts, implementation and effectiveness of BMP's, and corrective actions taken to protect water quality.
Annual Costs: $3,500
FTE Needs: 0.1 FTE

Validation Monitoring

Validation monitoring is conducted to show if the assumptions or models used in planning are correct. It is usually carried out at the Regional level in conjunction with research. Validation monitoring may or may not occur within the North Revilla Project Area since this type of monitoring is built into a Forest-wide Action Plan.

Chapter 3
Environment and Effects

Outline

Chapter 3

Affected Environment and Effects of the Alternatives

Introduction

This chapter presents information about those aspects of the environment that may be affected by the activities in the proposed alternatives. The "Affected Environment" portion of each resource section describes the current condition of the resource, trends related to its status, and relevant characteristics that may be subjected to impacts from the alternatives. The "Effects of the Alternatives" portion of each section presents the direct, indirect, and cumulative effects (or impacts) of activities under the alternatives. Thus, this chapter combines into a single chapter information that in many Environmental Impact Statements appears in separate chapters (generally called Chapter Three–Affected Environment and Chapter Four–Environmental Consequences). This chapter provides the basis for the Comparison of the Alternatives section in Chapter Two.

Available Information

There is less than complete knowledge about many of the relationships and conditions of wildlife, fish, forests, jobs, and communities. The ecology, inventory, and management of a large forest area is a complex and developing science. The biology of wildlife species prompts questions about population dynamics and habitat relationships. The interaction of resource supply, the economy, and communities is the subject matter of an inexact science.

The interdisciplinary team (IDT) examined the data and relationships used to estimate the effects of the alternatives. The data and level of analysis used, were commensurate with the importance of the possible impacts (40 CFR 1502.15); and relevant discussion in the TLMP (1979a, as amended) and the TLMP Draft Revision (1991a) is incorporated by reference (40 CFR 1502.21).

When encountering a gap in information, the IDT concluded that the missing information frequently would have added precision to estimates or better specified a relationship. However, the basic data and central relationships are sufficiently well established in the respective sciences that the new information would be very unlikely to reverse or nullify understood relationships. Thus, new information would be welcomed and would add precision, but it was not essential to a reasoned choice amoung the alternatives as they are constituted.

Analyzing Effects

Effects are quantified (where possible), although qualitative discussions may also be included. The means by which any identified potential adverse effects will be reduced or mitigated are described in detail in Chapter Two.

Environmental consequences are the effects of implementing an alternative on the physical, biological, social, and economic environment. *Direct* environmental effects are defined as those occurring at the same time and place as the initial cause or action. *Indirect* effects are those that occur later in time or are spatially removed from the activity but would be significant in the foreseeable future. *Cumulative* effects result from the incremental effects of actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

For the purposes of this analysis, the reasonably foreseeable time frame over which the indirect effects are estimated is until the end of the Ketchikan Pulp Company (KPC) Long-Term Contract (the year 2004). This determination of reasonably foreseeable is based on the time frame of the KPC contract commitment (Appendix A).

The cumulative effects analysis in this document considers the Tongass Land Management Plan (1979a, as amended). Alternative 2 is used to display the reasonably foreseeable future actions, because this is the maximum harvest alternative, within Forest Plan standards and guidelines, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

The cumulative effects projected under any of the action alternatives are subject to changes when the TLMP Revision is complete. Decisions made during the revision process can provide for a new management emphasis in any given portion of the National Forest. Cumulative effects as analyzed in this document include both the effects of this project and those projected by the TLMP Draft Revision, Alternative P.

The following assumptions were made to assess the reasonably foreseeable effects to the year 2004. These assumptions reflect current management and technology of national forests and provide a uniform approach to estimating effects of timber harvest and road construction.

- Laws, standards, guidelines, and Best Management Practices (BMP's) for water quality would be followed. These requirements are expected to be at least as stringent in the future as they are today.
- Timber sale planning would use an interdisciplinary process.
- All acres of suitable land as identified in Alternative P of the TLMP Draft Revision would be equally subject to impacts.
- The no-action alternative would represent only a delay in implementing the TLMP and, based on volume projections in the ten year timber sale action plan, foreseeable cumulative effects would begin to occur before 2004.
- Future effects on resources from timber harvest and road construction would be similar to impacts projected for current alternatives.

Potential adverse environmental effects which cannot be avoided are discussed. Unavoidable adverse effects may result from managing the land for one resource at the expense of the use or condition of other resources. Many adverse effects can be reduced or mitigated by limiting the extent or duration of effects. Mitigation measures within standards and guidelines are specified for project activities to be implemented under the alternatives. These are discussed briefly throughout the chapter, and in detail in Chapter Two.

Short-term effects are those that occur annually or within the first ten years of project implementation. *Long-term productivity* refers to the capability of the land and resources to continue producing goods and services for 50 years and beyond.

Irreversible commitments are decisions affecting non-renewable resources such as soils, minerals, plant and animal species, and cultural resources. Such commitments of resources are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or the resource has been destroyed or removed. For example, a rock pit which is used to provide rock to build roads throughout the Project Area would be considered an irreversible commitment to the resource. Land-use designations allowing land-altering activities were established by the Forest Plan, but the actual commitment to develop, use, or affect non-renewable resources in the North Revilla Project Area was made during the development of this project.

Irretrievable commitments represent opportunities foregone for the period during which resource use or production cannot be realized. These decisions are reversible, but the production opportunities foregone are irretrievable. An example of such commitments is the allocation of land-use designations (LUD's) that do not allow timber harvest in areas containing suitable and accessible timber lands, a decision that is made at the Forest Plan level. For the time over which such allocations are made, the opportunity to produce timber from those areas is foregone, thus irretrievable. Irreversible and irretrievable commitments resulting from this project are discussed in more detail at the end of this chapter.

Land Divisions

The land area of the Tongass National Forest has been divided in several different ways to describe the different resources and allow analysis of how they may be affected by Forest Plan and project level decisions. These divisions vary by resource since the relationship of each resource to geographic conditions and zones also varies. Four of these are used for more than one resource, and are described briefly here.

Ecological Provinces. The Tongass National Forest identifies 21 large land areas that are distinguished by differences in ecological processes (TLMP Revision SDEIS, Chapter 3, Biodiversity). They are defined by a combination of climatic and geographic features. The North Revilla Project Area lies within the Revilla Island/Cleveland Peninsula ecological province (Number 15) and is discussed in the Biological Diversity and Wildlife sections of this chapter.

Management Areas. The 1979 Forest Plan (USDA Forest Service 1979a, as amended) divided the Tongass into 141 management areas, one of which are in the North Revilla Project Area. Each management area has area-specific direction and activity schedules. The Tongass Timber Reform Act directed that "proportionality" (see Chapter One, and the timber section of this chapter) be analyzed using the management areas. The 141 areas are therefore preserved in this analysis, and

are used to ensure that the proportionality requirement is met. (See TLMP Draft Revision, Proposed Revised Forest Plan, Chapter 5, for a detailed analysis.)

Value Comparison Units (VCU'S). These are distinct geographic areas, each encompassing a drainage basin containing one or more large stream systems. The boundaries usually follow watershed divides. The Tongass contains 867 VCU's; eight are found in the North Revilla Project Area. They are used to describe the locations of specific resources in the Project Area.

Wildlife Analysis Areas (WAA's). These are Forest Service land Divisions that correspond to Minor Harvest Areas used by the Alaska Department of Fish and Game. Approximately 190 apply to the Tongass National Forest of which two apply to the North Revilla Project Area. They are used in the Subsistence and Wildlife sections.

Geographic Information System

The Tongass National Forest has developed a computerized geographic information system (GIS) which was used for the development of this project. The GIS is a large data base, containing information on many of the resources of the Forest. Much of the data consists of layers, each representing a particular resource or attribute (such as vegetative species, soil types, or recreation places). This system makes it possible to do spatial analysis of alternatives and effects, and to rapidly display resource information in map (plot) format. Numerical data can also be stored, displayed and analyzed.

Description of the Ecosystem

The North Revilla Project Area lies within the Revilla Island/Cleveland Peninsula ecological province. This Province includes Revillagigedo, Annette, Duke, and Gravina islands and the Cleveland Peninsula south and west of Eagle Lake. This province is a combination of climatic and geographic features. The Revilla Island/Cleveland Peninsula Ecological Province includes 1,169,559 acres, of which 109,520 acres are within the North Revilla Project Area.

The Cleveland Peninsula portion of the province is a part of the mainland of southeast Alaska's panhandle region. The remainder of the ecological province is made up of Revillagigedo Island.

The Project Area is mountainous, often rising abruptly from sea level to several thousand feet. Elevations of forested areas extend up to approximately 2,000 feet in the Project Area.

Abiotic Components

The configuration of the coastline, the warm Japanese ocean current, and the high coastal mountains provide the factors necessary to produce abundant rainfall. Storms and moderate to heavy precipitation occur year round, but most commonly from September through November. The abundant moisture feeds numerous streams, rivers, and lakes.

The North Revilla Project Area has a maritime climate, resulting from the moderating influence of the Pacific Ocean. In the summer, this provides a cooling influence, while in winter, temperatures are warmer than would be expected for these latitudes. Normal temperatures range from the mid-40's to the mid-60's in the summer, and from the high teens to the low-40's in the winter. During the warmer months,

temperatures are highest inland and lowest along the coasts, while in the colder months, the reverse is true.

The North Revilla Project Area has complete cloud cover about 85 percent of the year. October is generally the wettest month. High precipitation persists through the middle of November when intermittent snowfall occurs. Snowfall varies according to elevation and distance inland from the coast. Snow accumulation below 500 feet elevation is short-lived, generally melting off within a few days, due to warmer temperatures and rain.

The local climate has had a significant influence upon the landscape ecology of Revilla Island. Moderate temperatures and ample precipitation produce good growing conditions for commercial forest species. Relatively low annual temperatures and abundant moisture produce slow rates of decomposition, resulting in the characteristic buildup of organic matter over much of the areas landscape. Storms, producing strong winds, in excess of 80 knots, and heavy precipitation may be expected during the fall season, September thru December. The winds generated by these storms are significant factors in the development of forest stands. Blow-down events ranging from a few trees, to several hundred acres may occur. These windthrow events, accompanied by heavy precipitation, and saturation of the soil may be a significant trigger for landslides in forested areas. Windthrow events are further discussed in the Silvilculture section of Chapter Three.

The long-term climatic reporting station at Bell Island, just to the north of the Project Area reported annual observations from 1929-1952. Table 3-1 shows mean bi-monthly temperatures and precipitation from the Bell Island recording station.

Table 3-1
Bell Island Observations (1929-1952)

	Fahrenheit Temperature	Precipitation in inches
January	29.5	11.17
March	34.6	8.12
May	48.7	4.94
July	58.6	5.47
September	53.0	11.35
November	36.5	13.49
Annual	43.7	108.67

SOURCE: Arrasmith, 1992

Biotic Components

The coastal forest of the Revilla Island/Cleveland Peninsula Ecological Province is part of the cool, temperate rainforest that extends along the Pacific coast from southern British Coumbia to Prince William Sound. Most of the forest is composed of old-growth conifers, primarily western hemlock and Sitka spruce, with mountain hemlock, western redcedar and Alaska yellowcedar other major components. Red alder

is common along streams, beach fringes, and on sites recently disturbed by logging and landslides. Subapline fir occurs occasionally at tree line.

Blueberries, huckleberry, Sitka alder, devil's club, and salal are common shrubs in the forest. Plant growth on the forest floor includes deerheart, dwarf dogwood, single delight, and skunk cabbage. Mosses grow in great profusion on the ground, on fallen logs, on the lower branches of trees and in forest openings.

Grass-sedge meadows usually are located along lakes and major streams. Interspersed throughout the forest are muskegs, supporting plant communities dominated by sphagnum mosses and sedges.

The alpine zone usually lies above 2,500 feet. It occupies the area above the coastal forest and is seperated from the forest by a subalpine or transition zone. Alpine plants have adapted to snowpack and wind abrasion by evolving low-profile growth forms. Low, mat-forming vegetation covers most alpine areas, with cushion-like plants occupying crevices on rock outcrops and talus slopes.

The forests, shorelines, streams, and rivers of Southeast Alaska provide habitat for over 350 species of birds and mammals, including both nongame animals and animals such as black bear, Sitka black-tailed deer, moose, wolf, mountain goat, beaver, otter and marten. Many of these are found in the Project Area. The coastline provides an ideal habitat for a large population of bald eagles, and wetlands provide nesting habitat for waterfowl.

A highly productive marine environment includes an abundance of marine mammals, halibut, herring, and of shellfish. Both resident and anadromous fish are found within and adjacent to the Project Area, including five species of Pacific salmon, Dolly Varden char, cutthroat trout, and steelhead trout.

AIR QUALITY

Key Terms

Ambient Air - that air, external to building, encompassing or surrounding a specific region
Ambient Air Quality Standard - the prescribed level of pollutants in the outside air that cannot be exceeded legally during a specified time in a specified geographical area
Class I Airshed - one of three classes of areas provided for in the Clean Air Act for the Prevention of Significant Deterioration program. Class I airsheds are the "cleanest" and receive special visibility protection
Class II Airshed - the second of three classes of areas provided for in the Clean Air Act. Class II Airsheds have no specific attainment criteria
Jack Pot Burning - The process of burning only large concentrations or clumps of fuels and skipping the intervening areas of light fuels.
PSD - Prevention of Significant Deterioration of ambient air quality is a program established by the Clean Air Act to protect air quality and air quality related values

Affected Environment

Although there is little scientific information on the baseline air quality of the North Revilla Project Area, the air quality of the region is generally good. Exchange of air typically comes from relatively pollution-free air off the Gulf of Alaska. Local sources of airborne particulates include motor vehicle emissions, motor vessels and cruise ships, dust, residential and commercial heating sources in the Ketchikan Gateway Borough population center, marine traffic on Tongass Narrows, the Ketchikan Pulp Company mill at Ward Cove and a limited amount of prescribed burning.

The State of Alaska Department of Environmental Conservation has the primary responsibility for attainment and maintenance of Ambient Air Quality Standards under the provisions of the Clean Air Act (see TLMP Revision Supplement Draft EIS for related air quality discussion). The entire Project Area is a Class II airshed and does not have specific attainment criteria under the Clean Air Act. There are no Class I airsheds designated in the State of Alaska.

Typical indicators of air quality include levels of sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, lead, and particulate matter less than or equal to 10 microns. The particulate matter (PM-10) indicators are utilized because the human respiratory system cannot efficiently filter out particulate matter this small or smaller. Wildfires and prescribed fires can be a major source of fugitive particulate matter less than 10 microns in size. The smokey haze seen during a large forest fire is composed primarily of particulate matter less than 10 microns in size.

Effects of the Alternatives

Direct, Indirect and Cumulative Effects

There is presently little information on the possible effects of ambient air quality on forest resources in Southeast Alaska. Forest health monitoring recently initiated under a national resource program includes air resource related parameters. Methods of conducting inventories are being developed to address this information need. Monitoring of baseline resource conditions on the forest is being conducted at this time.

National Ambient Air Qulaity Standards (NAAQS) for indicators of matter less than 10 microns (PM-10) in size are established by EPA as the concentration limits needed to protect all of the public against adverse effects on public health and welfare. PM-10 indicators are utilized because the human respiratory system cannot efficiently filter out particulate matter this size or smaller. Wildfires and prescribed fires can be a source of fugitive particulate matter less than 10 microns in size.

PSD, Prevention of Significant Deterioration of ambient air quality, is a program established by the Clean Air Act to:

a. Protect public health and welfare from any actual or potential adverse effects from air pollutants not withstanding attainment and maintenance of all national ambient air quality standards.

b. Ensure economic growth will occur in a manner consistent with the preservation of existing clean air resources.

c. Preserve air quality and air quality related values in areas of special national or regional natural, recreational, scenic or historic values.

d. Ensure that any decision to permit increased air pollution is made only after there has been adequate opportunity for informed public participation in the decision making process and after careful evaluation of all consequences.

The NAAQS for particulate matter less than 10 microns in size would not be violated by the proposed action. PSD increments in the Southeast Alaska Intrastate Air Quality Control Region, for sulpher dioxide, oxides of nitrogen and total suspended particulate, have not at this point in time, been triggered, making an analysis uneccesary.

All action alternatives may require burning of debris after harvest (see Chapter 3 - Silviculture and Timber), and the resulting smoke would affect air quality. Only sites scheduled for red and yellow cedar planting will be prescribe burned, if necessary to reduce fuel loading. The purpose of the burning is to reduce fine fuels, and increase the number of plantable spots. Cedar sites often contain significant amounts of cull material, which can result in large concentrations of jackstrawed fuels after timber harvest. The larger logs often have copious amounts of twigs and branches attached that support the logs up in the air. These thickets of logs and limbs are impossible to penetrate, which means that significant portions of the site would not regenerate successfully within NFMA time frames (5 years). The objective would be to "jackpot" burn the larger piles and reduce the high concentration of fine fuels (less than 1 inch in diameter). This will cause the larger logs to fall to the ground and allow the planting crews to easily and safely plant young seedlings over the entire stand.

Prescribed burning was the selected method for treating the fuels concentrations because the other potential methods would have been ineffective and inefficient. Piling Unmerchantable Material (PUM) is not acceptable in SE Alaska because of the limitations of track vehicles on steep, wet soils. Yarding Unmerchantable Material (YUM) is not practical for the following reasons: 1) requires large landings; 2) the road system is not connected to anywhere, so the piles would remain forever; 3) ecosystem management research indicates that leaving the large logs in place would have numerous benefits in terms of site productivity, site protection, and as habitat; 4) logging costs would be much higher; and 5) YUM yarding would require treating every potential site while the yarder is still rigged up. Prescribed burning would only occur, if a post sale survey indicates that it is really needed. There is a high probability that no prescribed burning will actually be required, but that cannot be determined until after logging is complete.

Woody debris related to road construction is used for slash filter windrows on fill slopes and is not usually burned. Fugitive dust generated from road construction and increased vehicular traffic may also temporarily affect air quality. Table 3-2 displays the acres to be prescribed burned by alternative.

Table 3-2
Acres of Woody Debris Disposal by VCU and Alternative

VCU Number	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
732	0	20	0	0	21	0
733	0	0	0	0	0	0
735	0	40	40	40	0	40
736	0	48	60	74	48	60
737	0	25	25	25	38	25
738	0	21	35	0	35	0
739	0	0	0	0	0	0
740	0	0	0	0	0	0
Total Acres	0	154	160	139	142	125

SOURCE: Nightingale, 1993
Note: This information derived from Ketchikan Area Geographic Information System (GIS), North Revilla Silviculture Coverage

Alternatives 2 and 3 treat the highest number of acres through prescribed burning and are likely to have the greatest adverse effects on air quality. Alternatives 4 and 5 treat the same number of acres and would cause slightly more impact on air quality than Alternative 6. Alternative 1, the no action alternative has the least effect on air quality.

Protection of visibility is important for a variety of reasons. Visibility is most severely impaired by particulate matter. Based on emission factors, the greatest emissions would be generated from those alternatives that prescribe burn the most acres and fuels per year (Ward, et al 1988). Predicted particulate emissions resulting from burning woody residue in the Project Area by alternative are displayed in Table 3-3.

Table 3-3
Particulate Matter (PM-10) Emission by Alternative

Alternative	3 Year Burned Ac/Yr	Woody Debris Tons/Ac	PM-10 Emissions Tons/Year
1			
2	51	25-50	5 - 10
3	53	25-50	5 - 11
4	46	25-50	5 - 9
5	47	25-50	5 - 9
6	42	25-50	4 - 8

SOURCE: Nightingale, 1993

Particulate matter emissions would temporarily reduce air quality, which could have short-term impacts on recreation and visual quality in the area immediately surrounding the prescribed burn. Based on previous experience (sites within the Project Area were prescibed burned in the late 1980's), no impairment to visual quality within Misty Fiords National Monument is expected because of the distance, wind patterns, and expected dissipation of the smoke column prior to entering the Monument's airshed. There are no communities near the Project Area.

Prescribed burning will occur only on days of good to excellent smoke dispersal. Smoke from prescribed fires is managed by developing burning plans and prescriptions to minimize environmental effects upon air quality.

Control of prescribed burning for smoke pollution is the responsibility of the State of Alaska Department of Environmental Conservation. Certain types of open burning, including management of forest land require prior written approval from the Department. Burning plans that may impact sensitive areas such as population centers will require more specific detail than plans for remote areas. If the Department determines that the airshed is being overloaded with smoke, a termination of the existing and proposed burning may be required.

The action alternatives would result in a continued supply of raw wood products to the Ketchikan Pulp Company mill at Ketchikan. This would indirectly affect air quality in the immediate area.

The indirect and cumulative effects of the proposed action alternatives upon air quality will be a continuation of the existing local ambient air quality.

WATER RESOURCES

Key Terms

Bedload - sand, silt and gravel, or soil and rock debris rolled along the bottom of a stream by moving water
Best Management Practices (BMP's) - land management methods, measures or practices intended to minimize or reduce water pollution
Biotic - living
Mitigation - measures designed to counteract environmental impacts or to make impacts less severe
Sediment - water-transported earth materials
Stream flow regime - the characteristic discharge of water from a watershed that occurs in the natural stream channel
Solute - substance dissolved in a solution
Turbidity - an indicator of the amount of sediment suspended in water
V-notch - a deeply incised, narrow valley along a drainage with a characteristic "V" shaped cross-section

Affected Environment

The North Revilla Project Area is characterized by an abundance of water. These water resources can be broken into three areas of consideration. These include: (1) consumptive water use; (2) stream flow regime; and (3) water quality, including sediment, water temperature, and water chemistry. All of these are influenced by climate, which is discussed in the Introduction to Chapter Three. Additional information about watersheds and fish habitats are discussed in the Fisheries section of this chapter.

Consumptive Water Use

Key consumptive water uses within the Project Area include domestic and commercial water supply, recreation cabin water and supply, power generation, and the propagation and enhancement of fish resources. Existing uses include:

- Forest Service recreation cabins—Blind Pass, Plenty Cutthroat, and Orchard Lake utilize surface water sources in the vicinity of the cabins as a water supply.
- Southern Southeast Regional Aquaculture Association (SSRAA) Neets Bay Fish Hatchery utilizes surface water from the Neets Creek and lake system for domestic water supply, power generation, fish propagation and enhancement.
- Margaret Creek fish pass utilizes surface water from the Margaret Creek and Lake system for propagation and enhancement of anadromous fish resources.

A potential use of the water resources within the Project Area is by SSRAA for a sockeye salmon hatchery at Shrimp Bay for the propagation and enhancement of fish and power generation.

There are no congressionally designated municipal watersheds within the Project Area.

Stream Flow

River and stream systems are located throughout the Project Area. These usually originate in the mountains of central Revillagigedo (Revilla) Island and flow westward toward Behm Canal. All streams and rivers produce a large volume of water per unit of land. Runoff varies greatly, depending on the time of year. Spring snowmelt is the likely cause of increased runoff between April and June. In some streams spring runoff can often approach fall runoff, which generally is the period of highest stream flows. Two relatively low flow periods are characteristic of these systems: the first occurs between January and March due to snow and ice accumulation, and the second during mid-July to August due to low precipitation.

Water Quality

In Alaska, the Alaska Department of Environmental Conservation (ADEC) is the responsible State agency for promulgating and enforcing water quality standards under the Clean Water Act. ADEC and the USDA Forest Service have entered into an agreement to commit to the responsibilities and activities of implementing the water quality protection tasks described in the *Alaska Non-point Source Pollution Control Strategy*, approved by the U.S. Environmental Protection Agency (EPA), August, 1990.

Changes in any of the physical and chemical properties of water can directly affect water use by people and other living organisms. The Neets Creek, Traitors Creek, and Margaret Creek systems are three of the watersheds in the Project Area which require maintenance or improvement of water quality to protect beneficial uses. The most important characteristics for water management on the Project Area are temperature, sediment, and chemical properties, especially dissolved oxygen and introduction of foreign chemicals. These water quality characteristics are discussed below and correspond to the key water quality parameters identified in the State of Alaska water quality criteria for maintaining natural productivity of stream, lake, and estuary organisms.

Temperature

Water temperature is a principal regulator of biological activities in the aquatic environment. The metabolic activity of fish, and most other aquatic organisms, is controlled by water temperature. This activity proceeds most efficiently within a limited temperature range. According to State of Alaska Water Quality Standards for growth and propagation of fish and other aquatic life, water temperature shall not exceed 65 degrees F at any time, and the maximum temperature shall not be exceed 58 degrees F for fish migration and rearing, and 56 degrees F for spawning, egg and fry stages.

The principal source of heat for small streams is solar energy striking the stream surface. Most Southeast Alaska streams are not highly sensitive to temperature changes. Frequent cloudiness, low air temperatures, steep channel gradients, and frequent precipitation generally keep stream temperatures below the range considered harmful to fish. (See the Fisheries section of this chapter for further discussion on the effects of temperature to fish.) Potentially temperature sensitive streams in the North Revilla Project Area have one or more of the following characteristics:

south-facing slopes, lack of immediate downstream forested stream buffers, historical and continued harvest activities, shallowness, flow, adjacency to ponds or muskegs, and fish production (FSH 2609.24).

Sediment

Water-transported earth materials are called sediment. Sediment in streams may be transported as either suspended or bedload sediment. Suspended sediment is carried within the water column, while bedload material moves (rolls or bounces) along the bottom of the stream or riverbed. Suspended sediment causes water to appear murky or turbid. Under natural conditions both suspended and bedload sediments move during storm runoff events. The rate of sediment transport depends on discharge velocity and availability of materials. Natural suspended sediment concentrations in watersheds in Southeast Alaska are typically low (Paustian 1987). A small undisturbed second order tributary to Kadashan Creek on Chichagof Island produced an annual sediment yield of 0.08 tons per acre; suspended sediment ranged from 1 mg/l to 4mg/l. After road construction activity, the same watershed produced 0.12 tons/acre in annual sediment yield.

Stream sediment originates from both geologic processes and human activities. The main natural processes creating sediment are landslides and actively developing stream systems. A regional study (Swanston 1989) indicates that about three percent of all major landslides directly affect fish-bearing streams. Steep terrain and large amounts of rainfall make the land sensitive to natural sediment production.

The major sources of management induced sediment in the area result from: (1) road construction activities, (2) road use and maintenance, and (3) logging activities.

Water Chemistry

Dissolved oxygen is typically at or near saturation in fast-running streams in the Project Area because the churning action tends to bring oxygen into the water. Muskeg streams in the Project Area typically are slightly acid (pH 6.5). Although water in Southeast Alaska is never completely free of organic and inorganic matter, chemical water quality is high. Concentrations of total dissolved solids are typically less than 150 ppm.

In the past, introduction of foreign chemicals—such as motor oil, fertilizers and other petroleum products—into surface waters of the area has been very low.

Effects of the Alternatives

Direct and Indirect Effects

Application of Best Management Practices (BMP's) and standards and guidelines will minimize sediment delivery by controlling surface erosion from roads and harvest units. This will be accomplished by avoiding or minimizing landslide and surface erosion risk potential, and by proper design and installation of road drainages and stream crossings (see Chapter Two, Mitigation Measures). There is however, risk of catastrophic events, large landslides, that may occur naturally and cannot be predicted.

The effects of the many land management activities on resident and anadromous fish, on human water supplies, and on other beneficial water uses are complex and not easily quantified. Direct, indirect, and cumulative effects result from potential changes in erosion, sedimentation, stream temperature, recruitment of large woody debris, and the stream nutrient cycle. Further details on impacts to fish habitat and production from proposed alternatives are discussed in the Fisheries section of this chapter.

Stream flow

BMP's applied in the Project Area (see Unit Card Appendix K, for site specific application) would reduce the potential for changes in streamflow regimes. See Mitigation Measures, Chapter Two, for a discussion of the stream buffering that will be done under all action alternatives. Where harvest units are dispersed throughout a drainage basin, the effects of destructive rain or snow flood events should lessen.

Water yield responses to timber harvest activities have received very little study in Southeast Alaska's watersheds. Based on the accuracy of the equipment used, no changes in stream flow were measured in the Maybeso watershed following clearcutting of 25 percent of the drainage basin (Meehan et al. 1969). An analysis of Staney Creek drainage basin following a 35 percent clearcut harvest did show significant increases in summer low flows (Bartos, 1989).

Several variables (elevation, aspect, basin geomorphology, soils, vegetation, geology, snow storage, and precipitation patterns, cutting unit size, distribution of units within the watershed, and scheduling of harvest entries) could influence stream runoff.

Water Quality

The effectiveness of BMP's is determined by the degree to which water quality meets State standards. Although numerical standards are included in the Alaska State water quality regulations, measurements are difficult to routinely apply to the regulation of non-point sediment sources on road construction and timber sale sites. The Environmental Protection Agency (EPA) has determined that the reasonable implementation, application and monitoring of BMP's achieves compliance with the intent of the Clean Water Act. Water quality studies conducted in Southeast Alaska indicate that except for short-term localized deviations from numerical standards, BMP's are effective in maintaining sediment concentrations within State standards (Paustian 1987). Effects upon water quality in the Neets and Margaret Creek systems will be made minimal in all alternatives.

Stream Nutrient Cycling

The results of these investigations suggest that no measurable effects on chemical water quality or aquatic productivity would occur as the result of clearcut harvesting in the North Revilla Project Area. Soil and water chemistry monitoring on a small sub-basin that was clearcut and burned in the Pavlof drainage near Tenakee, Alaska, measured no loss in total nitrogen and only slight leaching of potassium, magnesium, and phosphorus into surface water (Stednick et al. 1982). Timber harvesting has not been shown to result in detrimental concentrations of dissolved solutes being flushed into surface water bodies (Chamberlin 1982). High concentration of dissolved nutrients that could impair drinking water or aquatic nutrient cycling are of principal concern. Research on coastal forest watersheds have measured only slight releases of key dissolved nutrients resulting from clearcutting and slash burning treatments (Fredriksen 1971).

Water Temperature

Timber harvest in Class III riparian areas may result in minor temperature changes to some streams in the Project Area. By maintaining buffers adjacent to Class I and Class II streams, the effects of harvesting small headwater drainages will be substantially mitigated. A 50- to 80-foot wide stream side buffer has proven to be effective in moderating solar radiation and reducing stream temperature increases (Brown et al. 1971). Stream temperatures in the Project Area do not generally exceed the maximum temperature threshold of 65 degrees F for growth and propagation of fish set by State water quality standards. The majority of Class III drainages in the Project Area originate on mid-to-high elevation mountain slopes. Base flow for these streams is typically supplied by snow-melt runoff, ground-water discharge or drainage of high elevation lakes and ponds. Channels are typically moderately to deeply incised, with steep gradients and high flow velocities and do not meet typical temperature sensitive criteria.

Dissolved Oxygen

The temperature, gradient and flow characteristics of the streams in the area generally assure dissolved oxygen contents at or near saturation at most times. The effects of timber harvest and road construction on dissolved oxygen are expected to be negligible for all alternatives.

Sediment

Estimates of sediment delivery to Southeast Alaska streams from timber harvest indicate that sediment increases are minimal and not distinguishable from natural fluctuations in sediment yield. In the Indian River on Chichagof Island, prior to harvest, two years of monitoring was conducted by the Forest Service. In 1978 and 1979, total sediment yield was 0.07 tons/acre and 0.16 tons/ acre respectively. Post harvest monitoring showed sediment yields in 1980 and 1981 of 0.11 and 0.14 tons/acre respectively (Paustian 1987). Suspended sediment values in Indian River during the study period ranged from 0.19 mg/l to 175 mg/l.

Some increases in sediment delivery to streams above naturally occurring rates can be expected to result from timber harvest and road construction (Rice et al. 1979; Madej 1982; Reid and Dunn 1984; Furniss et al. 1991; Chamberlin et al. 1991).

Sediment may be generated in each action alternative from short-term and long-term land disturbing activities. Sediment production and delivery to streams is roughly proportional to the amount of road constructed, slope gradient, soil type, the amount of use, the number of stream crossings, the proximity of the road to the stream, area of timber harvested, yarding system used, and the amount of naturally produced sediment. Construction of new roads expose soil, which may be eroded and cause sediment delivery to streams. Yarding and road construction on high or very high mass movement index soils may cause landslides that generate sediment. See the Soils and Roads and Facilities sections of this chapter for detailed effects of yarding and road construction and reconstruction on MMI soils.

Sediment from management activities may continue to be generated long after roads are constructed, timber is harvested, and stream crossings are in place. Maintenance of road surfaces and ditches exposes soil to erosion. As use is reduced and exposed soil becomes vegetated, the rate of erosion and delivery to streams generally will be reduced (Reid and Dunne 1984). Use of BMP's and filter strips will make minimal effects of sediment. The rate and extent of this reduction depends upon the rate of

vegetation establishment. Establishment of vegetation may be enhanced by closing roads and seeding exposed soil, as discussed in the Roads and Facilities section of this chapter.

The extent to which stream crossings deliver sediment depends on the maintenance strategy applied after harvest. If BMP's are implemented, such as maintenance of culverts and bridges, little additional sediment is produced.

Two of the watersheds in the Project Area support benefical uses of special concern. The Traitors Creek drainage and the Southern Southeast Regional Aquaculture Association hatchery at Neets Bay contribute significantly to the area's fisheries (see Chapter 3 - Fisheries). The proposed alternatives have the potential to affect the water quality and fish production at these facilities. The potential for direct effects on beneficial uses will depend mainly upon the topography and location of proposed roads and harvest units in relation to stream channels, and high landslide potential areas.

Hogan and Wilford (1989) developed a methodology to evaluate the potential for proposed activities to deliver sediment to streams. This methodology was modified for use in southeast Alaska by Paustian and Kelliher (1992). Harvest units are evaluated in relation to the topography, landslide potential (MMI class) and proximity to streams.

Sediment Transfer Hazard Rating Procedure

Harvest units in the Traitors and Neets Creek watersheds were evaluated for their sediment delivery potential to the nearest stream. For this analysis, it was assumed that all harvest units or roads have the potenital to produce sediment from surface soil erosion or landslides.

The topography, landslide potential, stream class, and channel type for each proposed harvest unit and road was analyzed. Each harvest unit and road segment was then assigned a sediment delivery class and sediment routing class:

Sediment Delivery Classes

Class 1: Very low levels of sediment delivery. The unit or road does not border or intercept any stream channel. A very broad, flat valley bottom or low relief terrain effectively disconnects the potential sediment source and the channel.

Class 2: Low levels of sediment delivery. The unit or road is separated from all streams by a wide valley bottom (valley bottom >5 times the active channel width) or low relief terrain. Only minor amounts of the potential sediment eroded will reach the channel.

Class 3: Medium levels of sediment delivery. The unit or road is separated from streams by a medium sized valley flat (valley bottom 3-5 times the active channel width) or low relief terrain; features may transfer low, but measureable amounts of the potentially eroded sediment to the channel.

Class 4: High levels of sediment delivery. The unit or road is separated from the stream by a narrow valley bottom (valley bottom <3 times the active channel width) or low relief terrain, but other terrain features will deliver much of the potentially eroded sediment to the channel.

Class 5: Very high levels of sediment delivery. The unit or road directly borders a stream channel. The terrain is steep and all sediment produced will be delivered to the channel. There is no flat valley bottom. Sediment sources are directly connected to the channel.

Sediment Routing Classes

Class 1: Very low levels of sediment routing. Low gradient channels (<1%), very wide valley bottom (>5 times active channel width), or lakes are present. These channels store sediment. Channel types: ES2, ES3, ES4, PA1, PA2, PA3, PA4, PA5.

Class 2: Moderate level of sediment routing throughout the channel. Few large sediment sinks; if present, lakes are small. Channel gradients are 1-2% and valley bottom is 3-5 times the active channel width. In channel bars are present. Channel types: FP3, FP4, LC1, FP5.

Class 3: High level of sediment routing. Channel gradient is 2-6%, with minor, localized low gradient sections. Channels deposits are less extensive and the channel is confined within a valleybottom 1-3 times the active channel width. Channel types: MM1, MM2, MC1, MC2, AF1, LC2.

Class 4: Very high level of sediment routing. Steep channels (>6%) with no channel deposits or flat valley bottom. Channel types: HC1, HC2, HC3, HC4, HC5, HC6.

The sediment transfer hazard indicates where in a watershed sediment production and movement is a potential problem for maintaining fish habitat. Sediment transfer hazard was determined by combining the sediment delivery and sediment routing classes of each unit and road on a specialized graph according to a process developed by Hogan and Wilford (1989). The product of this analysis, the sediment transfer hazard (ranging from 1 (very low) to 5 (serious), provides the relationship between erosion and downstream sedimentation impacts on fish habitat, but the system does not provide absolute quantities of sediment delivered. The quanitity of sediment delivered depends on precipitation, soil moisture and streamflow conditions at the time of sediment production. These conditions are factors that resource managers must consider when they undertake activities on areas that are linked to fish habitat.

Traitors Creek

The sediment transfer hazard for proposed harvest units in the Traitors Creek watershed are displayed below:

Table 3-4
Traitors Creek, Acres of Harvest Units by Sediment Transfer Hazard Rating Class

Sediment Transfer Hazard Rating Class	Acres of Harvest Units in Each Sediment Transfer Hazard Rating Class					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Very Low = 1	0	0	0	0	0	0
Low = 2	0	0	0	0	0	0
Moderate = 3	0	87	128	0	70	120
High = 4	0	739	515	84	498	455
Serious = 5	0	478	466	88	344	691

(SOURCE: Babik, 1993)

Neets Creek

A summary of the sediment transfer hazard ratings for harvest units in the Neets Creek watershed is displayed in Table 3-5.

Table 3-5
Neets Creek, Acres of Harvest Units by Sediment Transfer Hazard Rating Class

Sediment Transfer Hazard Rating Class	Acres of Harvest Units in Each Sediment Transfer Hazard Rating Class					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Very Low = 1	0	0	0	9	5	0
Low = 2	0	0	0	40	81	0
Moderate = 3	0	86	89	156	81	69
High = 4	0	546	55	344	418	103
Serious = 5	0	224	0	429	304	0

(SOURCE: Babik, 1993)

An analysis of sediment transfer hazard for individual harvest units and roads is contained in Appendix K, Sediment Transfer Hazard Ratings.

Consumptive Water Use

The effect of the proposed action on the consumptive uses of the water resources of the area will be insignificant in all alternatives. Application of BMP's will maintain

water quality for domestic and commercial water uses, as well as the other uses identified earlier.

Cumulative Effects

Most watersheds within the Project Area have experienced prior roading and timber harvesting. BMP's would largely limit most effects of sediment and increased flows from roads and harvest units (see Unit Card Appendix K for site specific application). By 2140, the all suitable and available forested land within the Project Area will be harvested and the transportation system will be constructed. This will result in a mosaic of forest stands of varying age, structure and composition.

Application of BMP's and adherence to Standards and Guidelines in the future will assure that the effects upon water resources are minimal.

Table 3-6 displays the percent of value comparison unit (VCU) harvested and roaded in the past, proposed harvest for this project by alternative, and additional total harvest to the years 2004 and 2140. Effects are expected to be greater in those drainages with the highest percentages of harvest. VCU 737 will see the greatest effects of timber harvest and road construction by 2140, approximately 43 percent of the area of that VCU.

Table 3-6

Cumulative Watershed Effects, Percentage of Value Comparison Unit Harvested and Roaded

VCU	Harvested and Roaded Before 1993	Harvested and Roaded by 1997 Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6	Harvested and Roaded by 2004	by 2140
732	0	0	6	0	0	9	0	9	29
733	12	12	17	15	17	16	17	17	36
735	14	14	22	20	23	22	23	23	39
736	18	18	26	25	24	26	26	25	39
737	24	24	34	27	35	35	28	35	43
738	18	18	32	28	26	28	28	31	39
739	13	13	21	27	15	19	20	21	32
740	19	19	21	20	22	22	20	22	38

SOURCE: Babik, 1993

Unless a cumulative watershed effects analysis is performed on watersheds within the Project Area, a 35 percent ground disturbance of the land base within a third order or larger watershed is acceptable within a 15-year period under standards and guidelines for cumulative effects (TLMP Draft Revision, pg. 4-63, 1991a). Due to the nature of the Area's coastal geography, third order or larger watersheds make up only about 42 percent of the Project Area. The majority of the Project Area is comprised of first or second order watersheds. To include the entire Project Area within the cumulative watershed effects analysis, we have decided to assess cumulative effects of the proposed action on a VCU basis, as well as third order or larger watersheds. VCU's generally follow watershed boundaries within the Project Area. Although VCU 737 is the only watershed that 35 percent of it's area will be affected by timber harvest and road construction in 1996, this activity has been on-going since prior to 1954. Timber harvest and road construction activity in the Project Area has been relatively light in the past 15 years.

This risk of unplanned events and cumulative effects is related to the amount of timber harvest, rate of harvest, and location of roads within a watershed. Although the amount of risk cannot be quantified, the frequency of such events in the past has been low, and the risk of future unexpected detrimental effects should be minimal because of the implementation of standards, guidelines, and other protective measures. (See Marine Environment and the LTF's section of this chapter.)

Table 3-5 displays the percent of watershed affected by existing and proposed ground disturbing activities and associated roading during the 15-year period, 1982-1997. To

minimize cumulative watershed effects which would adversely affect soil and water resources and result in changes in stream channel equilibrium, such as: 1) changes in sediment transport leading to stream aggradation, degradation and/or streambank erosion; 2) silting of pools; and, 3) reduction in aquatic habitat capability, the Forest Plan Revision requires that large scale ground-disturbing activities and associated roading be limited to no more than 35 percent of the acres of third order or larger watersheds in less than a 15-year period.

Table 3-7

Cumulative Watershed Effects, Percentage of Watershed Harvested and Roaded in Third Order or Larger Watersheds

Watershed Number	Watershed Harvested and Roaded 1982-1997					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
C11A	0	10	3	3	11	3
C12A	0	12	12	12	5	12
C13A	7	5	2	5	4	5
C30A	0	4	2	3	3	0
C33A	0	0	0	8	0	8
C34A	0	12	14	13	8	16
C40C	0	0	0	0	0	0
C41B	0	10	1	11	10	2
C43A	0	3	0	20	23	0
C59B	5	8	7	0	8	9
C60C	5	9	8	2	5	7
D13A	6	4	2	6	6	2
D57B	3	13	8	9	10	9
D58C	0	17	6	1	4	1
D67A	0	0	1	0	0	0

SOURCE: Babik, 1993

Table 3-8 displays the percent of high gradient contained stream channels (Channel types HC1, HC2, HC3, HC4, HC5, HC6) which have been harvested or proposed for harvest during the period of 1977-1997, in third order or larger watersheds. The Forest Plan Revision limits cumulative harvest rates in this land use designation to 25 percent or less every 20 years of a third order or larger watershed.

Table 3-8

Cumulative Watershed Effects, Percentage of High Gradient Contained Process Group Harvested

Watershed Number	Process Group Harvested 1977-1997 Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
C11A	0	10	4	4	14	4
C12A	0	16	16	16	5	16
C13A	12	16	0	16	14	15
C30A	0	0	0	0	0	0
C33A	0	0	0	13	0	13
C34A	0	19	18	25	0	18
C40C	0	0	0	0	0	0
C41B	0	5	0	7	5	1
C43A	0	1	0	15	25	0
C59B	9	15	13	15	14	16
C60C	12	17	13	14	15	17
D13A	9	10	11	16	16	11
D57B	4	16	12	12	12	11
D58C	0	10	8	0	0	0
D67A	0	0	0	0	0	0

SOURCE: Babik, 1993

GEOLOGY, MINERALS AND CAVE RESOURCES

Affected Environment

Key Terms

Alluvium: sand, silt, clay and gravel laid down by a river or stream
Carbonate rock: rocks such as limestone and dolomite which contain a high content of calcium carbonate, $CaCO3$
Cirque: a circular basin, a natural amphitheater formed at the head of mountain valleys by glacial erosion
Diorite: a granular igneous rock made up of mainly of feldspar and hornblende
Fjord: a long, narrow arm of the sea, bordered by steep cliffs, formed by glacial erosion
Gabbro: a granular igneous rock made up of mainly dark colored minerals, labradorite and augite
Glacial till: gravel, boulders, sand and finer materials transported and deposited by a glacier
Graywacke: fine-grained, sedimentary rock made up of fragments of slate or schist
Isocline: a fold of geologic strata so tightly compressed that the parts of each side dip in the same direction
Karst: a type of topography that develops in areas underlain by soluble rocks, primarily carbonate rocks such as limestone. Sinkholes and caves are formed when the subsurface layer dissolves.
Lithology: the science dealing with the mineral composition and structure of rocks
Phyllite: a slaty rock with lustrous surfaces due to the high content of mica flakes
Pleistocene: the epoch forming the first half of the Quaternary period, originating about one million years ago

The geology of the northwest part of Revillagigedo (Revilla) Island affects all of the areas other physical and biological characteristics. The geological characteristics of the Project Area may be described by the geomorphological, lithological and structural geology.

Geomorphology

The North Revilla Project Area has been heavily modified by Pleistocene and post-Pleistocene glaciation. The Project Area is characterized by fjords, glaciated valleys and ridges that trend in an east-west direction from the former centers of glacial origin in the mountains to the east. The features characteristic of glaciated coastal areas are easily recognized in the Project Area. Southeast Alaska has one of the best developed fjord systems in the world, deep sea channels, such as Behm Canal and Gedney Pass, carved to great depths by coastal glaciers. The deep waters adjacent to the shore in much of the Project Area make poor sites for log

transfer facilities (LTF's) and other shore access developments. One of the most striking characteristics of a well-developed glaciated valley is the U-shape of its cross profile, with a nearly level valley floor, filled with glacial debris, and considerably over-steepened side-walls, approaching vertical in places. Terrain of this nature typically has good sites for the growth of commercial tree species on the valley floor and lower sideslopes. The valley sidewalls are usually difficult to access and much of this extremely steep ground is unsuitable for the production of commercial wood products. The Traitors Creek valley and the small cirque lake at the head of the south fork of Traitors Creek are examples of glacial influence. The surrounding ridgetops, with their rounded profiles and relatively low relief are characteristic of areas overridden by glacial ice. These ridgetops are often above treeline or are relatively wet sites which do not support stands of commercial timber. While road construction on many of these ridges would be relatively easy, access from the valleys below is difficult.

Lithology

The lithology or bedrock geology of the northwest corner of Revilla Island consists mainly of a group of metamorphosed and deformed rock strata including dark-gray slate, phyllite and graywacke, andesitic or basaltic volcanic rocks, conglomerates and inclusions of gabbro and diorite. Running through these bedded rocks are locally abundant dikes and sills of granodiorite and quartz-diorite. While the masses of gabbro and diorite which make up the core of these mountains form relatively stable structures, the slates, phyllites and graywackes which overlay or are adjacent, form landscapes susceptible to landslides and other erosional processes. Quartz-diorite and granodiorite probably make the most competent road surfacing material in the Project Area. The gabbro and diorite are typically less competent. Slates, phyllites and graywackes break down rapidly into fine material when used on road surfaces. All of these rocks are adequate for base material, although the quartz-diorite and granodiorite are often difficult to reduce into proper sized material.

Structural Geology

The geologic structure of the Project Area consists mainly of a series of southwest trending overturned isoclines that are cut by high-angle faults. The bedded nature of the slates, phyllites and graywackes that make these isoclines, particularly when oriented parallel to the ground slope, provide failure plains that facilitate landslides and other slope failures. Numerous minor faults give the landscape much of its characteristic structure, with numerous parallel, acutely and obtusely intersecting drainage features.

Minerals

Minerals are legally divided into three groups: locatable minerals, leasable minerals, and saleable minerals.

Locatable Minerals

A locatable mineral is any mineral which is "valuable," in the usual economic sense, or has a property that gives it distinct and special value. Examples of locatable minerals on the Tongass National Forest are gold, silver, copper, molybdenum, iron, nickel, lead, and zinc. There are two mining claims located within the Project Area (see Land Adjustments, Uses and Permits section of this chapter). The potential for location and development of locatable minerals in the Project Area appears to be low (Coldwell 1989).

Leasable Minerals

Federally-owned leasable minerals include oil, gas, coal, geothermal resources, potassium, sodium, phosphates and sulfur. Presently, there are no leasable mineral applications or pending applications, prospecting permits, or geophysical exploration permits on the Project Area. No leasable mineral commodities are presently being produced on the Tongass National Forest. The anticipated demand for leasable minerals is expected to remain low. There is one known geothermal area near the Project Area, the Bell Island hot spring, just to the north.

Saleable Minerals

Saleable, or "common variety," minerals include sand, rock, building stone, gravel and other similar materials. The predominant saleable commodity in the Project Area is crushed rock used to construct roads. There are also deposits of sand and gravel throughout the Area.

Cave Resources

There are no known occurrences of carbonate rock (Berg 1988) and associated cave resources within the Project Area. However, it is suspected that carbonate rock may occur on the north side of Neets Bay. It is possible that karst features have developed in this area.

Effects of the Alternatives

Geomorphology

None of the alternatives will have an effect on the geological characteristics of the Project Area.

Minerals

The proposed project will have minimal effect upon the locatable and leasable minerals within the Project Area. Expansion of the present transportation system could open more areas for exploration, or facilitate future development.

Alternatives 2, 3, 4, 5 and 6 will develop sources of saleable mineral material, crushed rock, for use in the construction of roads throughout the Project Area. Future demand for common varieties of mineral materials in the Project Area is anticipated to remain low.

Cave Resources

The potential for identifying significant cave resources within the Project Area during implementation is low. However, if cave resources are identified that may be affected by the proposed activities, appropriate mitigation measures will be applied during harvest unit layout.

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SOILS

Key Terms

Alluvium - material deposited by rivers, and streams, including sediment laid down in river beds, flood plains and at the foot of mountain slopes and estuaries
Bedload - sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water
Glacial Till - gravel, boulders, sand, and finer materials transported and deposited by a glacier
Mass Movement Index (MMI) - rating used to group soil map units that have similar properties with respect to the stability of natural slopes
Muck - decomposed plant material, with little evidence of the original plant remaining
Muskeg - a type of bog that has developed in depressions, or flat areas, poorly drained, acidic, with organic soils that support vegetation that is predominantly sphagnum mosses and heaths
Riparian area - the area including a stream channel, lake or estuary bed, the water itself, and the plants that grow in and on the land next to the water
Sediment - solid materials, in suspension or transported by water, gravity, ice, or air
Slip plane - closely spaced surfaces along which differential movement takes place in rock
Soil productivity - capacity of a soil to produce plant growth, due to the soil's inherent chemical, physical, and biological properties
V-Notch - a shallow to deeply cut stream drainage, generally in steep, mountainous terrain; would look like a "V" from a frontal view
Windthrow - areas where trees are uprooted, blown down, or broken off by storm winds

Affected Environment

Introduction

The soils of Revillagigedo Island are the foundation upon which the ecosystem is built and functions. The soil is the interface between the biotic and abiotic components of the ecosystem, the medium in which many of the complex interelationships characteristic of forested ecosystems take place. The soil provides the medium for plant and animal growth and is the source of the productivity which drives the ecosystem.

Soils on Revillagigedo (Revilla) Island are found on a variety of terrains shaped by glaciation and characterized by U-shaped valleys with mountains extending 2,000 to 3,000 feet above sea level. Glacial till of variable thickness occurs in the valley bottoms and up to 1,500 feet on the sideslopes. Many of the valleys have numerous

rocky knobs scoured by glaciation. See the Geology section of this chapter for further information.

Soil development in Southeast Alaska is influenced by high levels of rainfall, cool maritime temperatures, and moderately low yearly soil temperatures. Under these conditions, organic matter decomposes slowly, resulting in a thick layer of organic material. In general, the other ecosystem components, parent material, topography, vegetation, animals, and climate influence the features of soils that affect and are affected by timber harvest activities. Soils influence the overall ecosystem functions, vegetation composition, water quality, riparian area and wetland values, and productivity of timber, fish, and wildlife in the North Revilla Project Area.

A soil inventory which identifies the soil types, their distribution and extent, has been completed on the North Revilla Project Area (Soil Survey for the Ketchikan Area, USDA Forest Service, unpublished.). Soil descriptions and pertinent soil references are available in the Ketchikan Area Supervisor's Office. Soil references include: the Tongass Land Management Plan (TLMP Revision, 1991a) Chapters 2 and 5; the Forest Ecosystems of Southeast Alaska (Swanston 1974); the Southeast Area Guide (USDA Forest Service 1977); the Alaska Regional Guide (USDA Forest Service 1983); and soil inventory maps and associated soil series and map unit descriptions.

Soil Groups

Soils within the Project Area can be grouped by typical properties that influence the use and management of an area. Five soil types are important in the Project Area: (1) mineral soils, composed mainly of sand, silt, clay, gravel and rocks, (2) organic soils, composed of partially decomposed plant tissues (muck); (3) soils formed over compact glacial till; (4) Tonowek and Tuxekan soils, made up of alluvial sand, silt and gravel; and, of special management concern, (5) the McGilvery soil series. This latter soil is composed of a thin layer of organic material overlaying bedrock.

Mineral Soils originate from deposits of glacial till, outwash, lacustrine deposits, alluvium, colluvium and residual materials from sedimentary, metamorphic and igneous rock. Glacial materials are found in U-shaped, glaciated valleys and lowland areas, and are extensive up to 1,500 feet in elevation.

The mineral soil surface typically consists of partially decomposed organic material. Soil depths range from less than 20 inches to more than 20 feet. Drainage ranges from well to very poorly drained. The ecosystem these soils typically support is characterized by a hemlock or hemlock-spruce vegetation series. Secondary plant succession on these soils typically is dominated by Sitka-spruce, unless a large component of advanced western hemlock regeneration existed in the original stand. Sites that drain poorly often support a mixed-conifer or western redcedar series. Where the surface layer is thin, or heavily disturbed, primary succession, mainly Sitka and red alder plant communities, may be establish following timber harvest. Mineral soils consists of 90,366 acres (82 percent of the project area) of the North Revilla Project Area.

Glacial Till Soils are included as a type of mineral soil that formed in compact glacial till. These soils are typically found on lower valley sidewalls and low ridgetops. They are of management concern because of potential for landslides and problems involved in road construction. The dense, compact glacial till which underlies these soils is relatively impermeable. Water accumulates in the subsoil at the contact with this dense till, forming a layer which is relatively unstable and susceptible to sliding. Glacial till soils make up about 1,066 acres of the Project Area.

Tonowek and Tuxekan Soils are composed of stratified silt, sand and gravel and are found on stream bottoms, alluvial fans and floodplains. They typically support a riparian ecosystem of water dependent plants including Sitka spruce, devils-club and red alder. Tonowek and Tuxekan soils previously harvested for timber are now in various stages of secondary plant succession. These soils are valuable as riparian habitat. About 1,126 acres of the Project Area is made up of these soils.

Organic Soils are composed of dead and decomposing plant parts, are generally found on glacial and marine sediment deposits. The area's cool, moist environment prevents vegetation from decomposing quickly and results in accumulation of organic material on the surface.

Organic soils are widely distributed throughout Southeast Alaska. In the Project Area they are found from sea level to mountain tops. They occur on hills, ridgetops, valley bottoms, mountain slopes with considerable gradient, on glacially-scoured benches, glacial till deposits, marine terraces and depressions. Forested organic soils may range from well to very poorly drained. Non-forested organic soils are usually poorly or very-poorly drained. They range from about 3 inches to over 40 feet in depth. Organic soils in Southeast Alaska typically support an ecosystem characterized by mixed conifer, western hemlock-yellowcedar, western hemlock-redcedar or shore pine vegetation series. Or, if non-forested, they support a muskeg or alpine meadow ecosystem. Organic soils consist of 19,179 acres (18 percent of the Project Area) of the Project Area.

McGilvery Soils consists of a layer of organic matter which typically overlays bedrock. These soils typically support western hemlock, or western hemlock intermixed with cedar and spruce. Disturbance of the soil surface may result in exposure of the underlying bedrock. The Tongass National Forest has determined through the land management planning process that restocking of forests on areas of greater than 41 percent McGilvery soils cannot be assured within five years of final harvest and are classified as unsuitable for timber production. These areas consist of 12,973 acres of the Project Area.

Table 3-9 displays the acres of soil types by VCU.

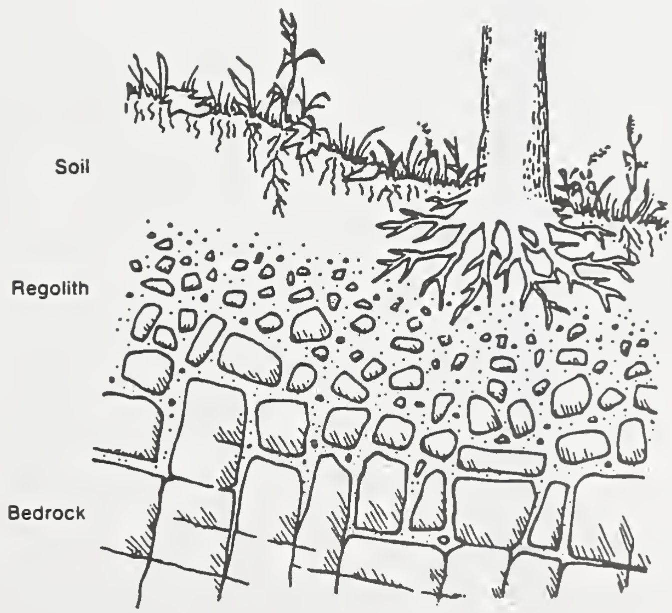
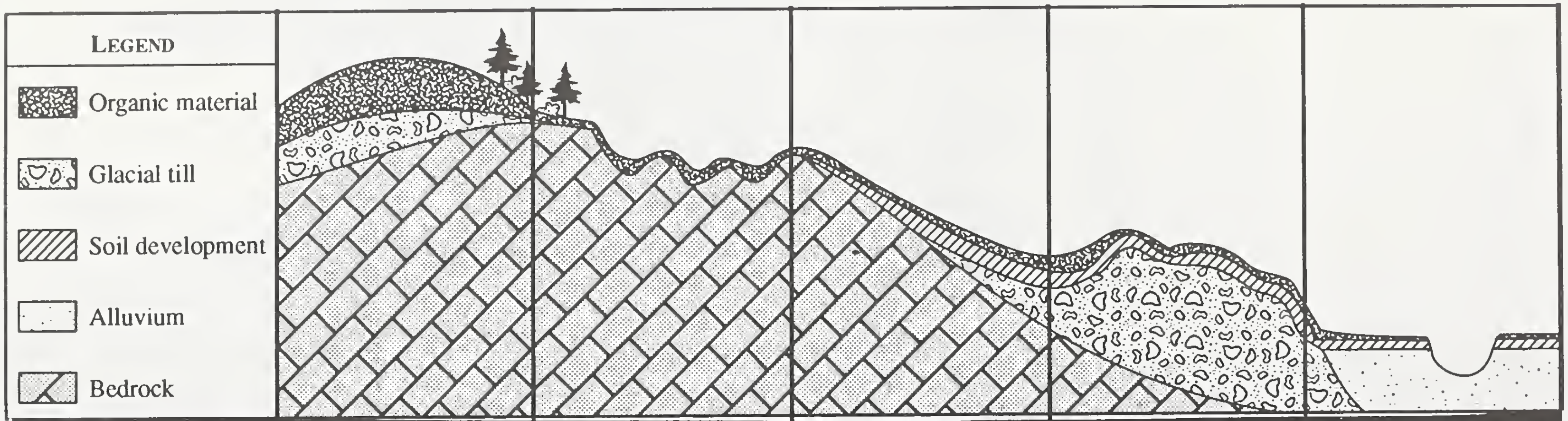


Table 3-9
Soil Type (Acres)

VCU	Glacial Till Soils	Tonowek Tuxekan Soils	Other Mineral Soils	Total Mineral Soils	McGilvery Soils	Other Organic Soils	Total Organic Soils
732	149	52	3,943	4,144	560	74	634
733	43	182	14,387	14,612	2,464	669	3,133
735	0	0	7,673	7,673	2,259	140	2,399
736	0	0	10,284	10,284	2,707	0	2,707
737	123	159	12,251	12,533	788	498	1,286
738	438	310	14,970	15,718	1,215	2,673	3,888
739	313	423	21,259	21,995	1,923	160	2,083
740	0	0	3,406	3,046	893	2,155	3,048
Total	1,066	1,126	88,173	90,005	12,809	6,369	19,178

SOURCE: Babik, 1992

Figure 3-1
Soil Characteristics



	ORGANIC	MCGILVERY	MINERAL	TILL	TONOWEK AND TUXEKAN
DESCRIPTION	Thick layer, partly to decomposed plant materials	Forest litter and partly decomposed plant material over bedrock	Shallow to deep soils developing in residuum or colluvium	Thin surface, soils developing in glacial till	Shallow to deep soils of stratified sand and gravel
TEXTURE	Mucky peat	Peat	Sandy loam to silt loam	Sandy loam to silt loam	Sand and gravel
SOIL DEPTH	7" to > 6'	< 8"	1' to > 6'	< 20" to < 6'	> 6'
DRAINAGE	Poorly and very poorly drained	Well drained	Well to poorly drained	Well to poorly drained	Well to moderately well drained
MAJOR FOREST TYPES	Nonforest and varied forest types	Western hemlock	Western hemlock, mixed conifer	Western hemlock, Western hemlock/ yellowcedar	Sitka spruce
LANDFORM	Ridgetops, benches, depressions, valley floor	Upper backslopes of hills and mountains	Valley floors, hillslopes, mountain sideslopes, ridgeslopes	Moraines, drumlins, and valley floor deposits	Floodplains, stream terraces
MASS MOVEMENT INDEX CLASS	Generally low	Low	Low to very high	Low to very high	Low
TIMBER SITE PRODUCTIVITY CLASS	Low to moderate	Medium to high	Medium to high	Medium to high	High
WETLAND HABITAT POTENTIAL	High	Low	Medium	Medium	Very high
UPLAND HABITAT POTENTIAL	Low	Medium	High	High	Very high

Soil Properties

Long-term Soil Productivity

Soil and its productivity are critical elements, since they also affect the productivity of the entire forest ecosystem. Tree growth and wildlife and fish habitat are often associated with soil productivity (the soil component of long-term site productivity), which is the inherent capacity of a soil to support the growth of specific plants or plant communities (FSM 2554.03). In the Project Area, timber site productivity and forage production of mineral soils ranges from very high on floodplains, till plains and most other lowlands, to medium to high on moderately well to well drained soils, to lowest on somewhat poorly to very poorly drained soils. Primary productivity on poorly and very poorly drained organic soils, regardless of elevation or northern extent, is generally much lower than the productivity of mineral soils.

Because of the importance of organic matter on forest productivity, maintaining the organically enriched topsoil layers is critical for maintaining long-term ecosystem productivity. Soil productivity and its related nutrient content can be influenced in a number of ways by timber management activities. Removal of the surface layer may be caused by landslides, surface erosion, severe yarding disturbance, or from displacement by roads, skid trails, landings or rock pits. Soils can also be damaged by puddling, which impairs soil porosity and drainage, and therefore reduces productivity. Changes in soil productivity that last beyond the planning period are considered to be significant impairments. Fifteen percent reduction in inherent soil productivity potential is the threshold for setting values for change in measurable or observable soil properties associated with long-term productivity (FSM 2554.03).

Soil Erosion

Two major types of erosion occur within the Project Area: (1) surface erosion, and (2) landslides.

Surface Erosion. Most undisturbed soils in the Project Area are resistant to surface erosion because they are generally protected by the surface layers of organic matter and the roots of vegetation. However, when mineral soils are exposed, erosion can occur. The rate of erosion depends primarily on the amount of vegetation ground cover, erodibility of the soil and the steepness of slope. Locations where surface erosion and mass wasting are most likely are along stream banks, snowslide or avalanche slopes, and within V-notches. Timber harvest activities and road construction may increase the erosion rate by exposing mineral soil.

Landslides. Landslides are the dominant process of natural erosion in ecosystems of Southeast Alaska. Many landslides occur during or immediately after periods of heavy rainfall when soils are saturated. Landslides usually occur on steep slopes that have soils with distinct subsurface "slip" layers (slip-planes), such as compact glacial till or bedrock that slopes parallel to the ground surface. These areas have a high likelihood of landslides, either naturally occurring or if disturbed by blasting rock or road pioneering, side casting of excavated material, or logging practices that cause substantial surface disturbance. Landslides occurring within the past 10 years and of a size greater than one acre are located at 23 sites within the Project Area, Table 3-10. These landslides range from one to over 25 acres in size.

Table 3-10
Landslides in the North Revilla Project Area

VCU	Number of Landslides (Greater than 1 Acre)	Acres of Landslides
733	2	15
737	6	21
738	5	15
739	10	49
Total	23	100

SOURCE: Babik, 1992

MASS MOVEMENT INDEX (MMI)

Mass Movement Index (MMI) ratings tell how susceptible soil groups are to landslides under natural conditions

- MMI 1 - low potential for landslides
- MMI 2 - medium potential
- MMI 3 - high potential
- MMI 4 - very high potential for landslides

Vegetation, particularly tree roots, seems to have a stabilizing effect on slopes, but tree roots tend to significantly decrease in strength five to seven years after a tree is cut (Swantson 1989). This decrease in soil holding capacityresults in an increased likelihood of soil movement on steep slopes following clearcutting. Effects of partial cutting on slope stability in Southeast Alaska are relatively unknown. Under natural conditions, windthrow is an important triggering device of landslides in Southeast Alaska. Recent research in Southeast Alaska (Swanston 1989) has suggested that although less than 10 percent of all landslides in the past 20 years were related to logging or roads, logging and roads may increase the potential for landslides in a given area.

A broad analysis of soil stability conducted on the Project Area was based on the Ketchikan Area Soil Survey. Landslide mass movement index (MMI) ratings were used to group soil map units that have similar properties with respect to the stability of natural slopes. Four classes of mass movement index—1(low), 2 (medium), 3 (high), and 4 (very high)—have been assigned to soil map units according to their relative potential for landslides, as indicated by their physical properties.

Naturally unstable soils are common throughout the Project Area. Areas where concentrations of high MMI soils occur are located in VCU's 733, 737, 738, and 739. Table 3-11 shows total acres of each mass movement index class in the Project Area by VCU. MMI ratings are based on general characteristics of typical soil map units.

Maps in the Planning Record display the distribution of high and very high MMI soils within the Project Area in relation to roads and harvest units for each alternative. These areas are also displayed for each unit in Appendix K, Unit Cards. Very high MMI soils are not suitable for timber harvest, as described in the TLMP Draft Revision (1991a), Timber Suitability Classification, pp. A1-16.

Table 3-11
Inventoried Mass Movement Index Classes in the Project Area by VCU

VCU	Low MMI=1 Acres	Medium MMI=2 Acres	High MMI=3 Acres	Very High MMI=4 Acres
732	2,507	1,232	987	64
733	7,956	4,568	4,871	315
735	4,839	3,487	1,642	122
736	5,838	3,685	3,432	105
737	4,362	4,202	5,140	116
738	7,287	3,764	6,489	730
739	8,759	7,201	7,946	1,424
740	3,756	1,175	1,397	122
Total	45,304	29,314	31,904	2,998

SOURCE: Babik, 1992

Effects of the Alternatives

Soils: Direct and Indirect Effects

Soil Productivity

The action alternatives have the potential to reduce soil productivity. However, application of soil management practices for the maintenance or improvement of soil productivity (FSH 2509.18) will limit these reductions below threshold levels (FSM 2554 R10 Supp. 2500-92-1). Furthermore, units were located and designed during the planning process to minimize adverse effects on soil productivity.

Areas of soil presently supporting productive ecosystems would be disturbed in all the proposed action alternatives to varying degrees. Disturbance of sites by road, landing and rock pit construction will result in the loss of soil. Timber harvest may result in soil disturbance, displacement or exposure, or puddling that could reduce soil productivity. Road construction and timber harvest may result in an increase in the occurrence of landslides (Loggy 1974; Swanston 1989) and may result in reduced productivity on those sites.

Estimated amounts of soil displacement which may be expected within harvest units with the proposed silvicultural and yarding systems are displayed in Table 3-12. In making these estimates several assumptions were made: (1) helicopter yarding systems will result in no soil exposure, regardless of silvicultural system; (2) soil exposure with all cable yarding and silvicultural systems will result in an average of 5.9 percent of the soil surface displaced or exposed within harvest units (based upon work by Landwehr, 1992); (3) shovel yarding systems will result in an average of 8 percent of the soil surface displaced within harvest units (Landwehr, 1992); and (4) partial

cutting (single tree, group selection, see Silviculture section of this chapter) will result in the same amount of soil displacement as clearcut silvicultural systems.

Table 3-12 displays the acres of soil displacement that may occur with each alternative.

Table 3-12
Soil Exposure (by VCU)

Acres of Soil Displacement by Alternative

VCU	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
732	0	11	0	0	17	0
733	0	39	30	29	29	39
735	0	41	28	32	27	35
736	0	41	46	34	29	42
737	0	61	32	53	69	32
738	0	106	98	53	80	73
739	0	81	97	50	71	97
740	0	5	3	7	8	3
Total Ac. Harvested	0	385	334	258	330	321
Percent of Total Harvest	0	4.7	5.9	4.4	5.1	4.9

SOURCE: Babik, 1993

Soil disturbances resulting from landslides and other surface disturbances often result in long-term reduction of soil productivity. The amount of time required for rehabilitation depends on the severity of the disturbance and its exposure to continued aggravating forces.

Soil Erosion

Some soil erosion and landslides may occur in all alternatives, including the no-action alternative. Erosion will most likely occur on areas where the soil surface has been exposed.

Two forms of erosion may be accelerated by timber harvest activity:

— **Surface Erosion** includes sheet, rill, and gully erosion on exposed mineral soils in harvest units, caused by felling and yarding activities, on road surfaces, cutbanks, and rock quarry sites.

— **Landslides**, which may be triggered by: (1) windthrow ; (2) soil disturbance through felling and yarding activities; and (3) road-building activities such as

blasting, excavating slope support, overloading slopes by sidecasting excavated soil materials, and directing and accumulating water.

Surface Erosion Some soil erosion may occur in all alternatives. Erosion will most likely occur on areas where the soil surface has been exposed (displaced). The amount of erosion that occurs will be related to the amount of soil exposure that takes place (Table 3-12). Due to the considerable amount of ground cover remaining on areas after timber harvest, erosion rates are typically quite low. Soil productivity may be reduced and sediment production may increase for a short period of time, until the site is revegetated, typically three to five years. Since each alternative includes a different amount of timber harvest and road construction, the alternatives are expected to result in differing levels of soil erosion. Of the action alternatives, Alternative 2 will result in the greatest amount of surface erosion. Alternative 4 will result in the least amount of erosion. Alternatives 5 and 3 rank second and third in the amount of erosion.

Landslides. Landslides are most likely to occur when roads are constructed on landscapes with very high mass movement indices (MMI). Landslides typically occur less frequently when roads are constructed or timber is harvested on areas with a lower MMI. In most cases landslides are not as common on areas with medium or low MMI.

A minor degree of soil disturbance is unavoidable under any reasonably practicable timber harvest activity. For the Project Area, 2,997 acres of the land base occur on soils inventoried as having a very high MMI. These soils are classified as unsuitable for the production of commercial timber. Timber harvest proposed on areas identified in the soil resource inventory as very high MMI will require soil site inspection during unit layout to validate inventory data at the project level. Order III soil resource inventory map units typically contain inclusions of soil which may be more suitable for a particular use than the inventoried soils. Soil resource inventory data is useful for modeling effects analysis but is not of sufficient detail for use in harvest unit layout. 29 percent of the forest land base occurs on soils inventoried as having a high MMI. Units with high MMI ratings will receive special consideration by a soil scientist to apply appropriate BMPs to timber harvest units. Road construction may require geotechnical evaluation. (See Mitigation Measures, Chapter 2).

Table 3-13 displays the amount of timber harvest that is proposed on each soil mass movement index class within the Project Area.

Table 3-13
Timber Harvest by Soil Mass Movement Index Class

Soil Mass Movement Index Class	Timber Harvest in Acres					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Low MMI=1	0	1,533	1,174	1,356	1,251	1,301
Medium MMI=2	0	2,380	2,025	1,414	1,809	2,162
High MMI=3	0	4,047	2,317	2,833	3,158	2,794
Very High MMI=4	0	216	225	203	162	266

SOURCE: Babik, 1993

Table 3-14 presents data on the amount of road construction upon soil mass movement index classes.

Table 3-14
Road Construction by Soil Mass Movement Index Class

Soil Mass Movement Index Class	Road Construction in Miles					
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Low MMI=1	0	34.9	22.6	26.0	35.7	22.3
Medium MMI=2	0	45.9	36.6	23.4	37.6	34.3
High MMI=3	0	68.6	40.6	42.1	60.8	37.3
Very High MMI=4	0	4.0	3.2	3.2	2.5	4.3
Total	0	153.4	103.0	94.7	136.6	98.2

SOURCE: Babik, 1993

Road building activities are sources of landslides and sediment. Preliminary monitoring reports of landslides initiated by road construction within the 89-94 KPC Long-term Sale EIS showed that 13 landslides occurred within a two-year period (Landwehr 1992). The total area disturbed from all 13 landslides was less than three

acres. A plan that minimizes road building over potential landslide areas would lessen the possibility of landslide occurrence and associated impacts. Table 3-14 includes miles of road construction on MMI soils for each alternative.

Of the action alternatives, Alternative 6 proposes building the least amount of road over high MMI=3 soils, and Alternative 2 proposes to build the most over these soil types. There is a low potential for measurable impacts to water quality and fish habitat from management-induced landslides if any of the action alternatives is implemented. The results of a recently completed Tongass-wide landslide survey can help illustrate the potential for landslide impacts in the North Revilla Project Area (Swanston and Marion 1991). This regional landslides survey, which included only large landslides greater than 100 cubic yards of soil displacement, estimates a landslide rate of 1.7 slides over a 20-year period. However, these results also indicate that a relatively small percentage of sediment generated from large landslide events will reach a stream. Swanston (1989) estimated that the increase in the incidence of landslides over natural occurrences throughout Southeast Alaska was about 3.5 times greater on managed acres.

Swanston's Tongass landslide survey categorized 23 percent of all landslides as debris torrents that occur in deeply cut V-notch gullies. Long-term impacts (greater than 10 years) to channel form and function and to fish habitat would be anticipated for Class I channel segments directly affected by a large landslide (Hogan and Wilford 1989). Based on Swanston's results, there is about a one-in-four chance that any management-related landslide will have an impact on Class I streams and only a very slight chance that impacts on fish habitat could occur. It can be inferred that the majority of these landslides would affect primarily Class III stream channels, since only about three percent of all natural and management-induced slide events in this survey were shown to directly affect Class I streams.

Care should be taken in extrapolating these results to the Project Area. Road construction and harvesting technology changes, as well as greater sensitivity to water quality and fish habitat concerns (as reflected in BMP's, for example, and much improved soil and water inventory information), have resulted in more effective management practices for timber operations in landslide prone areas. These factors will tend to reduce management-related landslide incidences in the Project Area from the rate observed by Swanston. On the other hand, many of the areas included in Swanston's survey had road systems that were predominantly located on stable locations on lower valley slopes. Roaded segments in the Project Area are proposed on relatively steep slopes, a factor which would tend to increase the potential incidence of road-related landslides. Thus, the frequency of landslide occurrence in the area is difficult to predict; however, areas with a high potential for landslide occurrence were evaluated in the planning process, and timber harvest was deferred in many of these areas during unit design.

Alternative 2 would have the greatest effect in 1997. Alternatives 3, 4, 5 and 6 show similar levels of soil disturbance by current activities (1993) and future activities. In all instances, the actions proposed would minimize soil disturbance to the maximum extent practicable through implementing the BMP's in the Soil and Water Conservation Handbook (FSH 2509.22).

The existing condition (1993), has constructed about 70 miles of roads in the Project Area, resulting in a loss of about 630 acres of soil in road right-of-way and rock quarry development since 1954. Approximately 990 acres of soil surface are estimated to have

been exposed by timber harvest activity in the Project Area. Alternative 1 would maintain this existing condition through 1997.

Alternative 2 would result in a total of about 220 miles of road construction and rock quarry development, covering about 630 acres, and 1,370 acres of soil exposure by 1997. It is estimated that Alternative 3 will result in a total of about 1,545 acres lost to road construction and quarry development and about 1,300 acres of soil exposed within harvest units. Implementation of Alternative 4 results in about 1,640 acres of road construction and rock quarry development and 1,270 acres of exposed soil surface by 1997. Alternative 5 produces about 1,970 acres of roads and quarries and 1,330 acres of exposed soil by 1997. Alternative 6 would result in a total of about 170 miles of road construction and rock quarry development, covering about 1,540 acres, and 1,300 acres of soil exposure.

Soils: Cumulative Effects

TLMP Draft Revision analysis forecasts that by 2140, within the Project Area, approximately 45,262 acres of regulated forest land will consist of a mosaic of even-aged stands of varying age classes and all-aged stands, the product of uneven-aged silvicultural systems. About 370 mile of road will have been constructed. These management activities will incorporate state-of-the art soil conservation practices as they are implemented. By maintaining soil productivity in the upcoming decades, the cumulative effects of these actions will remain within soil productivity threshold levels.

Cumulative effects of these actions upon long-term soil productivity are directly related to the amount of soil disturbance that occurs through time and the amount of recovery that takes place in the soil system during this time. The soil is a complex system with the capacity to absorb and recover from many of the impacts resulting from management of this nature.

Effects of road building activities are analyzed in all action alternatives.

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RIPARIAN AREAS, FLOODPLAINS AND WETLANDS

Key Terms

Estuarine - deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land, but which have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is diluted by freshwater runoff.
Hydrophytic vegetation - plants typically found in wetlands and dependent upon wetland moisture regimes for growth and reproduction
Muskeg - a type of bog that has developed in depressions, or flat areas, poorly drained acidic, with organic soils that support vegetation that is predominantly sphagnum mosses and heaths.
Primary succession - vegetation development that is initiated on surface exposed for the first time, which has never supported vegetation before
Riparian area - the area including a stream channel, lake or estuary bed, the water itself, and the plants that grow in and on the land next to the water
Riparian ecosystem - land next to water where plants that are dependent upon a perpetual source of water grow
Riparian management area - the area including water, land and plants that is at least 100 slope feet away from each side of perennial streams, lakes and other bodies of water
Secondary succession -the process of reestablishing vegetation after normal succession is disrupted by fire, cultivation, timber harvest, windthrow, or any similar disturbance
Wetlands - areas that are inundated by surface or ground water with a frequency sufficient, under normal circumstances, to support vegetation that requires saturated or seasonally saturated soil conditions for growth and reproduction

Affected Environment

Riparian Management Areas

Riparian management areas include stream or lake systems and the adjacent land. Approximately 14,895 acres of riparian management area are within the Project Area. A riparian ecosystem is identified in part by soil characteristics or distinctive plant communities that require free or unbound water (FSM 2526.05).

Within the Project Area, riparian management areas include perennial streams, bodies of water with actively flowing fresh water, bodies of fresh water which fish inhabit, and estuaries. Also included are the lands immediately adjacent to and associated with these areas which are dominated by riparian vegetation or provide water quality protection.

About 17 percent of all existing riparian management areas within the Project Area have been harvested between 1954 and 1990. Most of this timber harvest occurred in

the Margaret Creek watershed (VCU 738), with approximately 712 acres of riparian management area cut. Other areas where extensive amounts of riparian management areas have been harvested include: VCU's 733, 737,and 739, with 321, 465 and 465 acres of harvest respectively.

Riparian management areas previously harvested for timber are now in various stages of secondary plant succession. Except where the ground is highly disturbed, the stand composition on the secondary successional riparian areas is similar to riparian vegetation prior to timber harvest, with Sitka spruce typically forming the canopy. On the more disturbed sites where mineral soil was exposed during timber harvest activities, the vegetation is often composed of early successional species, such as red alder and salmonberry.

Floodplains

Floodplains are composed of naturally eroded sediments carried by the stream or river and deposited in slack water sections of channels during high water periods. Floodplains are considered to be areas subject to a one percent (100-year recurrence) or greater chance of flooding in any given year. Nutrient-rich sediments underlain by coarse textured sediments make floodplains the most productive lowland timber, wildlife, and fisheries resource sites on the Tongass.

The Project Area's floodplains are typically found in the bottom of broad, flat alluvial U-shaped valleys. They typically support a Sitka spruce series or shrub riparian plant community. About 1,125 acres of floodplains are identified by the soil resource inventory in the North Revilla Project Area. These are the Margaret (VCU 738), Traitors (VCU 739), and Neets Creek (VCU 737) valleys. At this time, no flood hazard studies have been conducted on the Ketchikan Administrative Area. Soils and landform inventories were used to make the initial determinations of the location and approximate boundaries of floodplains.

Table 3-15 displays the riparian and floodplain area acres by VCU within the Project Area.

Table 3-15
Acres of Riparian Areas and Floodplains

VCU	Riparian	Floodplain
732	550	52
733	2,175	182
735	990	0
736	1,416	0
737	1,701	159
738	3,044	309
739	4,337	423
740	682	0
Total	14,895	1,125

SOURCE: Babik, 1992

Wetlands

Wetlands are defined as: "those areas that are inundated or saturated by surface or groundwater with a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (40 CFR 230.41(a)(1)). Approximately 42,570 acres (39 percent) of the Project Area is classified as wetland. These include muskeg/shrub, estuarine, lacustrine (freshwater sedge meadows), forested wetlands (commercial and non-commercial), and riverine (freshwater streams). Descriptions of characteristics for these wetland types can be found in the TLMP Revision, 1991a, pgs. 3-423 and 3-424. Estuaries are discussed in more detail in the Fisheries section of this chapter. For defining wetlands the Forest Service uses the Corps of Engineers three-parameter (soil, hydrology, and vegetation) method. Wetland types were generated using soil resource inventory maps, based on correlations between soil series and plant associations. Hydrologic parameters were inferred from the soil (soil moisture regime) and vegetation (hydrophytic index) parameters (DeMeo and Loggy, Forest Service Report, unpublished).

The natural and beneficial values of each wetland type differ in terms of their benefit to wildlife habitat, fish habitat, hydrologic properties (flood flow moderation, groundwater recharge and discharge), site productivity, and water quality.

Skunk cabbage is a common indicator of local wetlands.

Value and Function. Wetlands are associated with significant values and functions. *Values* are defined here as socio-economic in nature, including: wildlife viewing and harvest, commercial fishing (critical salmon habitat provided by estuaries, streams, and lakes), development sites (for example, buildings and roads), community water supplies, actual and potential recreation, and timber harvesting. *Functions* are ecosystem attributes and can be organized as follows:

- *Physical functions*: flood conveyance, coastal erosion barriers, water retention and regulation, heat absorption, and sediment collection.
- *Chemical functions*: acidic water pH levels, high tannins, and ability to accumulate significant carbon and nutrients (nitrogen).

- *Biological functions*: wetlands in Southeast Alaska produce timber (generally in lower volume classes), provide critical habitat for fish (notably salmon) and wildlife (notably waterfowl and bears), and provide smaller animals as part of the food web. Wetlands feature high plant and animal diversity.

The total area of each wetland type within the Project Area is shown in Table 3-16. A wetlands map of the Project Area can be found in the Planning Record.

Table 3-16
Acres of Wetland Types by VCU in the Project Area

VCU	Forested Wetlands	Riverine Wetlands	Estuarine Wetlands	Lacustrine Wetlands	Muskeg/Shrub Wetlands
732	1,050	60	0	82	515
733	4,121	324	9	639	1,634
735	3,127	148	0	119	732
736	3,559	257	0	157	1,081
737	2,613	264	1	278	1,446
738	5,578	401	0	235	2,441
739	3,481	546	1	153	3,843
740	2,845	111	0	21	696
Total	26,374	2,111	11	1,684	12,388

SOURCE: Babik, 1992

Effects of the Alternatives

Direct and Indirect Effects

Riparian Management Areas and Floodplains

Executive Order 11988 directs Federal agencies to provide leadership and take action on Federal lands to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains. Agencies are required to: 1) avoid the direct or indirect support of floodplain development whenever there are practicable alternatives; 2) evaluate the potential effects of and proposed action on floodplains; 3) ensure that planning programs and budget requests consider flood hazards and floodplain management; and 4) prescribe procedures to implement the policies and requirements of the Order.

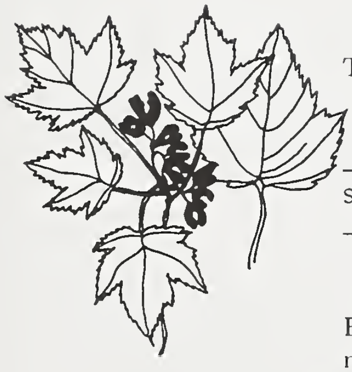
Many of the riparian management areas and floodplains in the Project Area have been affected since the 1950's. Road construction and timber harvest in riparian management areas in Margaret and Neets Creek valleys during the 1950's and 1960's have affected about 2,900 acres. Impacts have included disturbance of riparian soils and initiation of primary successions, resulting in replacement of spruce stands with even-aged stands of red alder.

Table 3-17 shows the area within each VCU that has been proposed for inclusion within timber harvest units. Riparian management areas are described by the Riparian Habitat Land Use Designation (RP) class which they include. See Fisheries section of this chapter for further discussion of RP's.

Table 3-17
Timber Harvest in Riparian Areas

VCU	RP Class	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
732	1	0	2	0	0	1	0
	2	0	4	0	0	4	0
	3	0	10	0	0	17	0
733	1	0	4	4	3	2	3
	2	0	3	2	1	3	2
	3	0	34	21	39	15	34
735	1	0	6	0	4	0	0
	2	0	3	6	3	3	6
	3	0	44	42	54	17	62
736	1	0	16	24	3	12	24
	2	0	15	9	5	2	20
	3	0	59	62	73	33	64
737	1	0	1	6	8	1	7
	2	0	3	2	3	2	2
	3	0	53	15	90	59	20
738	1	0	2	0	0	1	1
	2	0	9	9	2	12	8
	3	0	175	164	91	131	168
739	1	0	15	18	0	14	11
	2	0	14	14	0	9	9
	3	0	112	72	37	75	91
740	1	0	0	0	0	0	0
	2	0	0	0	0	0	0
	3	0	2	4	12	12	4
Total	1	0	46	52	18	31	46
	2	0	51	42	14	35	47
	3	0	489	380	396	359	443

SOURCE: Babik, 1993



Effects of the proposed harvest levels upon riparian management areas will be minimal. Adherence to Forest Plan harvest control prescriptions for Riparian Management Areas, along with monitoring, (see Chapter 2) will ensure that riparian values are maintained.

Impacts upon floodplains for the alternatives are generally limited to effects of road construction. Small areas of floodplains are proposed for timber harvest. Alternatives 2, 3, 4, 5 and 6 propose to harvest 55, 66, 39, 86 and 66 acres within floodplains.

During road construction, both direct and indirect impacts to Riparian Management Areas and floodplains may occur. There may be no detectable influence, or there can be flow alteration in minor streams because of routing by roadside ditches and culverts. Channel and flow alteration may locally affect the velocity of flows, width, and depth of water, and the location of flow. Such factors may physically result in different erosion and sediment transport characteristics.

Table 3-18 summarizes the number of roads that cross streams, that may affect riparian management areas within the three RP classes (Class I, II and III). All proposed new road construction is included.

Table 3-18
Number of Roads that Cross Streams in Riparian Management Areas

Stream Class	Alt. 1	Alt. 2	Alt.3	Alt. 4	Alt. 5	Alt. 6
Class 1	0	44	28	29	42	27
Class 2	0	64	54	33	55	·49
Class 3	0	219	147	116	186	124
Total	0	327	229	178	283	200

SOURCE: Rhodes, 1993

BMP's will be used to minimize impacts on floodplains as well as to protect roads and drainage structures. Examples of such practices include designing bridges and culverts to handle the expected flows, and installing frequent cross drains or ditch relief culverts to minimize erosion from large concentrations of water moving overland or where they center natural drainages.

Wetlands

Several forested and nonforested wetland types occur in the Project Area; these have been placed in five major groupings, as described in the Affected Environment portion of this section. Wetlands have value as habitat to a variety of wildlife species, some of which use wetlands seasonally or as travel ways. Other wetland values which may be affected by the proposed alternatives include value as timber sites, water supply and flood control.

Executive Order 11990, as amended, requires Federal agencies exercising statutory authority and leadership over Federal lands to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands. Federal agencies are required to preserve and enhance the natural and beneficial values of wetlands in carrying out their responsibility for: 1) acquiring, managing, and disposing of lands and facilities; 2) providing federally undertaken, financed, or assisted construction and improvements; and 3) conducting Federal activities and programs affecting land use.

Forest managers are required to consider alternative road locations and effects on wetlands. Roads are located outside of estuarine, lacustrine, and riverine wetlands, to the maximum extent possible, to maintain their function; see Table 3-16, Road Construction on Wetland Category. When it is necessary to cross wetlands, appropriate BMP's and mitigation measures are incorporated into road designs. Constructing roads on muskegs and forested wetlands requires rock overlay construction techniques which maintain the physical, chemical and biological functions of the wetlands. Road construction does cover wetland vegetation with rock, and may result in local changes in wetland vegetation. The interruption of subsurface drainage by making wetlands either wetter or dryer affects long-term site productivity. Detrimental altered wetness, identified when an area becomes perenially flooded or drained and the effective function or value of the wetland is lost, will be limited to those areas beneath and within a few feet of the road. Detrimental altered wetness will occur on less than one half of a percent of Project Area wetlands, a range of about 130 acres (Altenative 6) to 190 acres (Alternative 5), well within Regional standards for detrimentally altered wetness (FSH 2554 R-10 Supplement 2500-92-1). When possible alternate locations on adjacent non-wetlands are used.

Wetland vegetation will be affected by road construction.

BMP's designed to minimize effects upon water quality also serve to minimize the effects of timber harvest and road construction upon wetlands. Full suspension of logs and other low impact yarding systems minimize disturbance of wetland vegetation and surface water flow. Timber harvest is expected to have minimal long-term effects upon the physical, chemical and biological functions of wetlands.

The most biologically valuable wetlands—estuarine, lacustrine and riverine—will be minimally affected by this proposed action. Transportation facilities and timber harvest units are designed to make minimal the effects upon these valuable wetlands. BMP's and mitigation measures are applied to protect wetland resources (see Chapter 2 and the Unit Card appendix). Wildlife habitat values of forested wetlands may be affected by timber harvest by altering the forest structure. These effects are discussed in Chapter 3.

Data for proposed roads and units on wetlands were derived using the Ketchikan Area GIS data base.

Approximately 39 percent (42,570 acres) of the Project Area classifies as wetland; 62 percent (26,375) of these wetlands are forested wetlands. Many of the forested wetlands on the Project Area do not support commercial or economic stands of timber and are not scheduled for harvest in this or future plans. Larger muskegs supporting no commercial timber, will not be harvested, but may be affected by yarding operations within the unit. Table 3-19 presents data on proposed harvest on wetlands by alternative. Of the action alternatives, Alt. 4 harvests the least amount of forested wetlands, while Alt. 2 harvest the most acres. Alternatives 5 and 6 rank second and third in terms of most acres of forested wetlands proposed for harvest.

Timber harvest on forested wetlands involves manipulation of the vegetation, which temporarily changes the hydrology of the site. Patric (1966) suggests an increase in water yield may result from timber harvest. A temporary increase in soil moisture is expected until vegetation is established.

Timber site productivity on wetland soils is typically lower than on better drained soils. Growth rates on wetland sites are expected to be slower than non-wetland sites, and merchantable timber may not be available in a 100-year rotation. Areas where slow growth is expected ranges from 35 to 47 percent of the total timber harvest, depending on alternative (Table 3-19).

Table 3-19
Road Construction and Timber Harvest Activity on Wetlands by Alternative*

VCU	732	733	735	736	737	738	739	740	Total
Alternative 1									
Road Miles	0	0	0	0	0	0	0	0	0
Timber Harvest Acres	0	0	0	0	0	0	0	0	0
Alternative 2									
Road Miles	5.7	5.7	9.0	7.5	15.5	21.5	11.2	1.3	77.4
Timber Harvest Acres	136	209	257	391	538	809	332	38	2,710
Alternative 3									
Road Miles	0	2.9	6.4	5.4	5.3	17.3	8.8	0.1	46.2
Timber Harvest Acres	0	86	112	127	140	460	198	25	1,148
Alternative 4									
Road Miles	0	4.5	8.2	5.1	15.5	9.2	3.8	2.0	48.3
Timber Harvest Acres	0	183	174	170	245	274	53	39	1,138
Alternative 5									
Road Miles	6.4	4.7	6.2	7.8	18.7	21.2	8.3	2.0	75.3
Timber Harvest Acres	108	122	56	89	415	508	181	39	1,518
Alternative 6									
Road Miles	0	3.5	6.6	5.8	5.7	16.9	8.7	0.1	47.3
Timber Harvest Acres	0	128	136	236	141	464	189	25	1,319

SOURCE: Babik, 1993

* Most of the proposed timber harvest occurs on the forested wetland category; small areas of other wetland categories may be included in some harvest units. Road construction may occur on all wetland categories.

New road construction on wetlands will be limited to the needed transportation components of roads, landings, and drainage structures. Best Management Practices (BMP's) will be used, especially with regard to the use of wetlands as filter strips to capture sediment. Ditch construction will be minimized on open muskegs to the extent consistent with minimizing water accumulations on the road surface and sediment production. Roads through wetlands can affect the flow of water in the wetland. Placement of culverts and other road drainage features will ensure that flow and reach of water in the wetland are maintained at a natural level. Impacts from roads will be limited to the wetland directly underlying the road prism and associated cuts and fills.

Rock overlay construction on wetlands covers the vegetation but provides a highly permeable fill that minimizes changes in hydrologic conditions. No changes in chemical conditions are anticipated.

Table 3-20 presents data on proposed wetland alterations caused by road construction for each alternative, on specific wetland types. Action Alternative 3 affects the least amount of wetlands with road construction, and Alternative 2 affects the most.

Table 3-20
Road Construction on Wetland Category (Miles)

Wetland Category	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Forested Wetlands	0	59.6	36.8	34.6	56.1	37.6
Muskeg	0	18.2	9.5	13.6	19.4	9.8
Estuary	0	0	0	0	0	0
Riverine	0	0	0	0	0	0
Lacustrine	0	0	0	0	0	0
TOTAL	0	77.8	46.3	48.2	75.5	47.4

SOURCE: Babik, 1993

Application of BMP's during construction will assure that water flows, circulation patterns, and chemical and biological characteristics of the water within wetlands will not be impaired. Additionally, use of BMP's will assure that adverse impacts to the aquatic environment will be minimized. In terms of terrestrial environment, wildlife use of wetlands for travel ways and predation may be reduced during periods of vehicular traffic on the roads.

Indirect Effects of Timber Harvest on Wetlands

The indirect effects of road building and logging of forested wetlands within watersheds over time are another concern. The assumptions described below will be used to assess these effects.

Assumptions.

— Suitable timber base will remain the same. All analysis will be based on the operable timber within the VCU.

— Standards and guidelines for harvest and road construction activities will remain constant over the remaining contact period.
— Future accessibility of timber in relation to wetlands will be similar to the accessibility encountered in this sale.
— Distribution of wetlands is similar in all VCU's.

Prior to 1993, approximately 16,850 acres of timber were harvested in the Project Area. Approximately 5,543 of those acres, 33 percent, are forested wetlands. During this operating period (1993-1997), between 0 and 2,710 acres of forested wetlands are scheduled for harvest, depending on alternative (Table 3-19, earlier in this section).

The reasonably foreseeable future (2004) harvest is expected to include an additional 553 to 3,348 acres of wetlands. To obtain an estimated acreage of forested wetlands harvested, it is assumed that 33 percent of the proposed harvest will be forested wetlands.

Implementation of Alternative 1 would result in a continuation of the existing condition. Only the existing timber harvest on wetlands occurring before 1993, 5,543 acres, would occur until after 1997. Alternative 2 proposes the harvest of timber on all forested wetlands which would be available between the present and 2004, about 8,253 acres. Implementation of Alternatives 3, 4, 5 and 6 would result in a cumulative harvest of timber on 6,691, 6,681, 7,061 and 6,862 acres respectively, of wetlands in the Project Area by 1997. Regardless of which alternative is implemented at this time, all 8,513 acres of forested wetlands which are available are scheduled for harvest by 2004.

Indirect Effects of Roads on Wetlands. Prior to 1993, approximately 37.8 miles of road have been constructed over wetlands in the Project Area. This equates to less than one percent of all wetlands within the Project Area. The action alternatives propose up to 78 miles of additional road construction on wetland areas. Alternative 2 would result in the construction of 116 miles of roads on wetlands within the Project Area by 1997 (Table 3-20). Implementation of Alternatives 3, 4, 5, and 6 would result in the construction of 84, 86, 113 and 85 miles of road respectively, by 1997. Scheduled timber harvest within the Project Area will result in the construction of a cumulative 100 miles of roads on wetlands within the Project Area by 2004, regardless of which alternative is selected at this time. It is estimated that this additional 78 miles of new road construction will be necessary to access future timber entry through the reasonably foreseeable future (termination of the Long-Term Contract in 2004). Assuming clearing limits (75 feet) and assuming that 39 percent of the roads will be built on wetlands, an additional 707 acres of wetlands will have roads constructed over them.

Cumulative Effects

Riparian Areas, Floodplains and Wetlands

By 2140, within the Project Area approximately 4,100 acres of riparian areas, 630 acres of floodplains and 15,000 acres of forested wetlands will be harvested. These areas support a mosaic of even-aged stands of varying age classes and all-aged stands, the product of uneven-aged management. About 140 miles of road will have been constructed on wetlands. These management activities will incorporate TLMP Draft Revision standards and guidelines into the future. By maintaining riparian areas, floodplains and wetland values and functions in the upcoming decades, the cumulative effects of these actions will remain within threshold levels.

FISHERIES

Affected Environment

Key Terms

Aelvin - newly hatched salmon that are still attached to the yolk sac
Adfluvial - Species or populations of fish that do not go to sea, but live in lakes, and enter streams to spawn.
Alluvial fan channel - a fan-shaped deposit of sand, gravel, and fine material made by a stream where it runs out onto a level plain or meets a slower stream
Anadromous - fish that ascend from the sea to breed in freshwater streams
Aquatic Habitat Management Unit (AHMU) - areas for managing the resources associated with streams and lakes was renamed Riparian Area Land Use Designation by the TLMP Revision draft (unpublished)
Channel types - the defining of stream sections based on watershed runoff, landform relief, and geology
Estuary - relatively flat, intertidal, and upland areas where salt water meets fresh water, as at the heads of bays and the mouths of streams
Glide channel - channel types that occur on lowlands and landforms, and are mostly associated with bogs, marshes, or lakes
Large Woody Debris (LWD) - any large piece of relatively stable woody material having a diameter of at least 4 inches and a length greater than three feet that intrudes into a stream channel; also called Large Organic Debris (LOD)
Resident fish - non-migratory fish that complete their entire life cycle in fresh water.
Riparian Habitat Land Use Designation (RP) - areas for managing the resources associated with streams and lakes
Salmonid - refers to the group of fishes to which salmon belong.
Watershed - area that contributes runoff water to a waterway

Introduction

Fish and aquatic resources in the North Revilla Project Area help support subsistence, commercial, and sport fisheries. Abundant rainfall and watersheds with high drainage densities provide a number of diverse fish spawning and rearing habitats.

The fishery resources are important to the economy and lifestyles of area residents and its visitors. Residents from the communities of Meyers Chuck, Saxman, and Wrangell are regular subsistence users, and commercial fisheries attract people from Ketchikan, Neets Bay, Juneau, and Thorne Bay. (Resource Harvest Map, 1990, ADF&G).

The Project Area contains an existing fish hatchery at Neets Bay, a proposed fish hatchery, and an existing fish ladder at Margaret Creek.

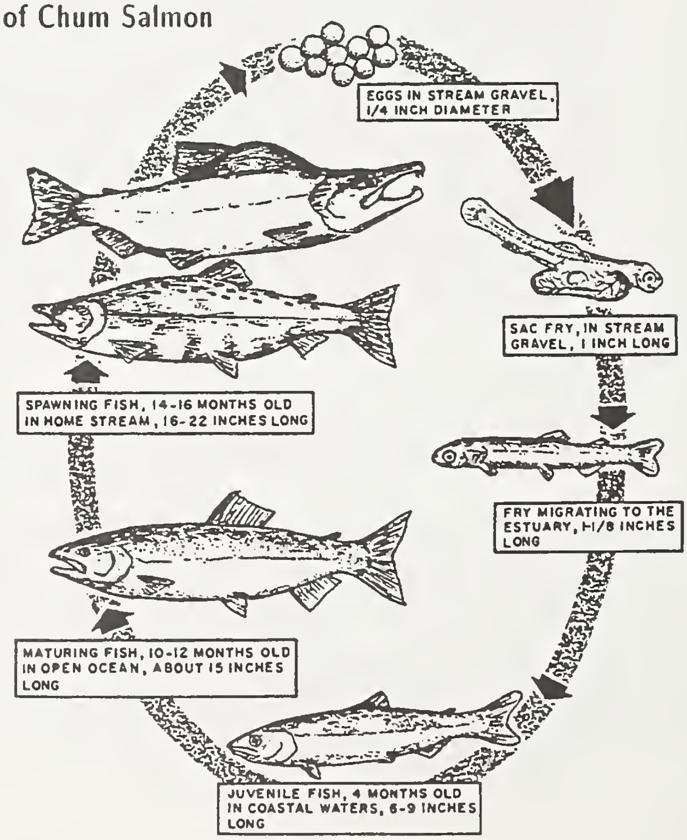
Four species of salmon (pink, chum, sockeye, and coho), cutthroat/rainbow trout, and one species of char (Dolly Varden) inhabit the fresh water within the area. A landlocked variety of sockeye salmon, the kokanee, is found in Orchard, and Margaret lakes. King salmon are found in the inlets and bays of the Project Area, but do not spawn in its streams. These fish species are valuable to the commercial fish industry, resident sport fisheries, subsistence use, and charter boat/lodge operators, and are also a valuable food source for bears, eagles, and other wildlife. A number of nongame fish species including sculpin, stickleback, and smelt occur in Project Area waters (Taylor 1979).

Anadromous fishes spend at least part of their life in fresh water and part in salt water. Salmon lay their eggs in stream gravels, and the juvenile fish hatched from the eggs emerge from the gravels. Depending on the species of salmon, the amount of time the juveniles spend in fresh water is variable. Pink salmon immediately start their downstream migration from emergence, while coho salmon juveniles generally spend two years in freshwater before migrating to the ocean. Pink and chum salmon are especially dependent on estuaries during their early life stages. Salmon reach maturity out in the ocean, only to return to their natal streams to start the cycle again. Steelhead trout follow a cycle similar to coho salmon, except they often survive the spawning season, return to the ocean, and spawn again.

Resident trouts and chars spend all of their life in fresh water, spawning in stream bed gravels and growing to maturity in the streams and lakes of the area.

In the Project Area, major estuaries are located at the head of Klu, Neets and Margaret Bay, and Fire and Traitors Cove. Additional small estuaries are found at the outlet of smaller stream systems throughout the Project Area.

Figure 3-2
Lifecycle of Chum Salmon



Estuaries are unique systems because they form transitions between terrestrial, fresh water, and marine environments. Estuaries are rich and diverse, harboring many resident species and providing food, spawning areas, or shelter for numerous other species at critical points in their life cycle (USDA Forest Service 1985). On North Revillagigedo (Revilla) Island, crab, shrimp, clams, mussels, and various marine fishes are associated with the estuaries and surrounding waters, which form a nursery for their young. Herring and smelt also use these areas for spawning and feeding.

Fish Habitat

Fish habitat is described in several ways, including: (1) stream classification, (2) Riparian Area Land Use Designation (RP), (3) watersheds, and (4) habitat capability.

Stream Classification

Three classifications of fish use of streams and lakes have been identified for the Tongass National Forest. Originally named Aquatic Habitat Management Units (AHMU), the TLMP Revision draft (unpublished) established instead Riparian Area Land Use Designation (RP). The three stream classes are also used to define RP classes in the AHMU Handbook (FSH 2609.24). The definitions include:

Stream Classes

Class I Streams
Provide high quality habitat for anadromous and sport fishes

Class II Streams
Provide habitat for resident fishes, but have limited sport fishing value

Class III Streams
Have potential influence on water quality of downstream aquatic habitat

Class I Streams with anadromous or adfluvial lake and stream habitat. Also included is the habitat upstream of migration barriers known to be reasonable enhancement opportunities for anadromous fish and habitat with high value resident sport fish populations.

Class II Streams with resident fish populations and generally steep (often 6-15 percent) gradient (can also have include streams from 0-5 percent gradient where no anadromous fish occur). These populations have limited sport fisheries values. These streams generally occur upstream of migration barriers or are steep gradient streams with other habitat features that preclude anadromous fish use.

Class III Streams having no fish populations, but have potential water quality influence on the downstream aquatic habitat.

All mapped streams in the Project Area have been assigned a channel type (USDA Forest Service 1992). Channel typing as developed on the Tongass National Forest is an inventory and planning tool that stratifies stream and lake sections within a watershed into different stream process groups. The process groups are based on physical characteristics of streams and predict their physical response to different management activities. For an in-depth description of stream process groups, see Appendix D of the TLMP Draft Revision, Proposed Revised Forest Plan (USDA Forest Service 1991a). For management requirements, see Appendix I of the TLMP Draft Revision, pp.12–20 (USDA Forest Service 1991a).

Channel types are used to assign stream classes, particularly if stream-specific information is unavailable. Of the approximate 851 miles of streams in the Project Area, some 493 miles were mapped and channel typed. Approximately 97 miles of stream in the Project Area are classed as accessible to anadromous fishes (Class I), and 75 miles are inhabited by resident fishes (Class II). (See Table 3-21.)

There were approximately 358 miles of previously unmapped streams identified during development of the streams GIS layer. These streams were originally identified using aerial photos and topographic maps. They were shown as 'unclassified' in the Draft EIS, but for analysis in the Final EIS have been reselected, preliminarily channel

typed, and stream classed. These newly classified streams are incorporated in all analyses within this section. Subsequent field reconnaissance will verify stream class and channel type to determine appropriate management prescriptions.

Channel types are also an indicator of the amount and quality of fish habitat within the Project Area. The amount and quality of rearing habitat predicted by the various channel types has been established through field studies within the Tongass National Forest (Murphy et al. 1987).

Table 3-21 displays the aquatic habitats by VCU, miles of Class I, II, and III streams, and acres of estuary and lakes.

Table 3-21
Aquatic Habitats by VCU

VCU	Miles Class I	Miles Class II	Miles Class III	Acres Estuary	Acres Lakes
732	5.7	3.6	5.0	0	66
733	20.4	10.0	45.5	67	611
735	6.7	5.5	27.0	12	111
736	9.0	9.8	42.6	8	155
737	13.1	3.8	41.6	66	261
738	17.8	15.9	68.6	71	211
739	20.5	20.3	76.1	210	120
740	4.1	6.4	14.1	0	0
Total	97.3	75.3	320.5	434	1,535

SOURCE: Zellmer, 1993

Riparian Area Land Use Designation (RP)

Riparian Area Land Use Designation (RP) are areas for management of the resources associated with streams and lakes. RP class designations reflect integrated resource management considerations for fish habitat, forest type, geology, soils, topography, and water quality. See the AHMU Handbook (FSM 2526.03 and FSH 2609.24) for further details on RP (AHMU) definitions.

RP widths are classified for the area according to the stream class and channel type that is present within the specific RP. For example, the TLMP Revision (unpublished) adopted the existing RP zones plus an additional 100 foot management area around all Class III streams. The physical characteristics and channel type sensitivities, and upland management influences within the RP, has been evaluated based on the inventoried conditions and responses to the management activities of the channel types. Additional widths for riparian, high mass movement soils (MMI-4), and uneven aged management zones may be applied beyond RP widths. Table 3-22 displays the RP widths along both sides of streams and lakes.

Table 3-22
Riparian Area Land Use Designation Minimum Widths

Channel Type RP LUD	Channel Type Old LUD	Bank Full Width	Plan Stream Class Code	No Comm. Level Min (feet)1	Select. Harvest Width (feet)2	No Prog. Harvest Width (feet)3	Plan Harvest Width (feet)4	Level Max (feet)5
Estuarine Process Group								
ES1	E4	27	1	100	100	0	200	200
		27	2a	100	100	0	200	200
		27	2b	100	0	0	0	100
		27	3	100	0	0	0	100
ES2	E3	33	1	100	100	0	200	200
		33	2a	100	100	0	200	200
		33	2b	100	0	0	0	100
		33	3	100	0	0	0	100
ES3	E2	40	1	100	100	0	200	200
		40	2a	100	100	0	200	200
		40	2b	100	0	0	0	100
		40	3	100	0	0	0	100
ES4	E1	80	1	100	100	200	200	200
		80	2a	100	100	200	200	200
		80	2b	100	0	0	0	100
		80	3	100	0	0	0	100
ES8	E5	66	1	100	100	200	200	200
		66	2a	100	100	200	200	200
		66	2b	100	0	0	0	100
		66	3	100	0	0	0	100
Palustrine Process Group								
PA1	L1	15	1	100	100	0	0	100
		15	2a	100	100	0	0	100
		15	2b	100	0	0	0	100
		15	3	100	0	0	0	100
PA2	L2	59	1	150	150	0	200	200
		59	2a	150	150	0	200	200
		59	2b	150	0	0	150	200
		59	3	150	0	0	0	150

continued

Table 3-22 continued

PA3	L4	39	1	100	100	0	0	100
		39	2a	100	100	0	0	100
		39	2b	100	0	0	100	100
		39	3	100	0	0	0	100
PA4	L5	54	1	100	100	0	0	100
		54	2a	100	100	0	0	100
		54	2b	100	0	0	100	100
		54	3	100	0	0	0	100
PA5	L3	25	1	100	100	0	0	100
		25	2a	100	100	0	0	100
		25	2b	100	0	0	100	100
		25	3	100	0	0	0	100
PA5	C7	25	1	100	100	0	0	100
		25	2a	100	100	0	0	100
		25	2b	100	0	0	0	100
		25	3	100	0	0	0	100
Flood Plain Process Group								
FP1	C4	57	1	150	150	0	200	200
		57	2a	150	150	0	0	150
		57	2b	150	25	60	0	150
		57	3	150	0	0	25	150
FP2	B8	66	1	100	100	200	0	200
		66	2a	100	100	200	0	200
		66	2b	100	25	60	0	100
		66	3	100	0	0	0	100
FP2	C6	60	1	150	150	0	200	200
		60	2a	150	150	0	0	150
		60	2b	150	0	60	25	150
		60	3	150	0	0	0	150
FP3	B1	20	1	100	100	200	0	200
		20	2a	100	100	60	0	100
		20	2b	100	25	0	0	100
		20	3	100	0	0	25	100
FP4	C1	49	1	150	150	0	0	150
		49	2a	150	150	0	0	150
		49	2b	150	25	60	0	150
		49	3	150	0	0	25	150
FP5	C3	108	1	150	150	0	0	150
		108	2a	150	150	0	0	150
		108	2b	150	25	60	0	150
		108	3	150	0	0	25	150

continued

Table 3-22 continued

Alluvial Fan Process Group								
AF1	B5	21	1	150	150	200	0	200
		21	2a	150	150	200	0	200
		21	2b	150	0	60	25	150
		21	3	150	0	60	25	150
AF2	A3	13	1	100	100	0	0	100
		13	2a	100	100	0	0	100
		13	2b	100	25	0	0	100
		13	3	100	100	0	25	100
Large Contained Process Group								
LC1	C2	54	1	100	100	0	0	100
		54	2a	100	100	0	0	100
		54	2b	100	0	0	25	100
		54	3	100	0	0	0	100
LC2	C5	60	1	100	100	0	0	100
		60	2a	100	100	0	0	100
		60	2b	100	0	0	25	100
		60	3	100	0	0	0	100
Moderate Gradient Mixed Control Process Group								
MM1	B2	17	1	100	100	0	0	100
		17	2a	100	100	0	0	100
		17	2b	100	0	25	0	100
		17	3	100	0	25	0	100
MM2	B3	46	1	150	150	0	0	150
		46	2a	150	150	0	0	150
		46	2b	150	0	60	0	150
		46	3	150	0	25	0	150
Moderate Gradient Contained Process Group								
MC1	B4	18	1	150	150	200	0	200
		18	2a	150	150	200	0	200
		18	2b	150	0	150	0	150
		18	3	150	0	150	0	150
MC2	B6	30	1	100	100	200	0	200
		30	2a	100	100	200	0	200
		30	2b	100	0	100	0	100
		30	3	100	0	100	0	100
MC3	B7	32	1	100	100	200	0	200
		32	2a	100	100	200	0	200
		32	2b	100	0	100	0	100
		32	3	100	0	100	0	100

continued

Table 3-22 continued

High Gradient Contained Process Group								
HC1	A6	13	1	100	100	0	0	100
		13	2a	100	100	0	0	100
		13	2b	100	0	0	0	100
		13	3	100	0	0	0	100
HC2	A7	17	1	100	100	0	0	100
		17	2a	100	100	0	0	100
		17	2b	100	0	0	0	100
		17	3	100	0	0	0	100
HC3	A2	23	1	100	100	0	0	100
		23	2a	100	100	0	0	100
		23	2b	100	0	0	0	100
		23	3	100	0	0	0	100
HC4	A5	18	1	100	100	0	0	100
		18	2a	100	100	0	0	100
		18	2b	100	0	0	0	100
		18	3	100	0	0	0	100
HC5	A4	13	1	100	100	0	0	100
		13	2a	100	100	0	0	100
		13	2b	100	0	0	0	100
		13	3	100	0	0	0	100
HC6	A1	20	1	100	100	0	0	100
		20	2a	100	100	0	0	100
		20	2b	100	0	0	0	100
		20	3	100	0	0	0	100

1) To determine the minimum Planning level Riparian Management Area for analysis, add 1/2 the Bank Full Width to the Minimum RMA and multiply by two.
2) No commercial timber harvest allowed within this zone.
3) Only selective harvest methods or uneven-aged management are allowed within this zone.
4) No programmed commercial timber harvest allowed within this zone.
5) To determine the maximum Planning level Riparian Management Area for analysis, add 1/2 the Bank Full Width to the Maximum RMA and multiply by two.
'2a' denotes Class II streams that flow directly into a Class I stream.
'2b' denotes Class II streams that DO NOT flow directly into a Class I stream.

These are minimum widths. The total width may equal or exceed the sum of the distances in many situations.

Buffers specified for all channel types are for one side of the channel. Buffer widths are measured as slope distance from the edge of the streams and lakes, and as slope distance inland from mean high tide from beach fringe and estuaries. Actual buffers prescribed in the field may be wider than indicated, depending on site-specific analysis. See Forest Service Management Prescriptions (Forest Service 1991a) and the BMP's (Forest Service 1991b) for additional requirements.

There are other requirements for determining the buffers not displayed here. Examples are the Riparian Soils, High Hazard (slide) soils, crowns of trees that do not extend past slope breaks, and maintaining 50 percent natural shading on temperature sensitive lake systems. These types of requirements can extend the buffer zones upon site specific examination of the area.

Table 3-23

Riparian Area Land Use Designation Widths for Lakes and Ponds

RP Class Type	(1) TTRA No Cut	Area (acres)	(2) No Comm. Harvest Width (feet)	(3) Select. Harvest Width (feet)	(4) No Prog. Harvest Width (feet)	(5) Min. Distance Riparian Width (feet)	(6) Plan Level Max. Width (feet)
1	Y	ALL	100	400		100	500
2	Y	> 50	100	400		100	500
2	Y	< 50	100			100	100
2	N	> 50			100	100	100
2	N	< 50 and >5		100		100	100
2	N	< 5				100	100
3	n/a	> 5		100		100	100
3	n/a	< 5				100	100

'>' Denotes the term Greater Than
'<' Denotes the term Less Than
1) 'Y' indicates that the lake or pond has a stream which is either a Class I stream or a Class II stream that flows into a Class I stream.
'N' indicates that the lake or pond DOES NOT have a stream which is a Class I stream or a Class II stream that flows into a Class I stream.
'n/a' indicates not applicable for this type lake.
2) No commercial timber harvest allowed within this zone.
3) Only selective harvest methods or uneven-aged management are allowed within this zone.
4) No programmed commercial timber harvest allowed within this zone.
5) The minimum Planning level Riparian Management Area for analysis purposes only. Buffers can exceed these distances when site specific information indicates that additional protection is to be taken.
6) The maximum Planning level Riparian Management Area for analysis purposes only. Buffers can exceed these distances when site specific information indicates that additional protection is to be taken.

Buffers specified for all channel types are for one side of the channel. Buffer widths are measured as slope distance from the edge of the streams and lakes, and as slope distance inland from mean high tide from beach fringe and estuaries. Actual buffers prescribed in the field may be wider than indicated, depending on site-specific analysis. See Forest Service Management Prescriptions (Forest Service 1991a) and the BMP's (Forest Service 1991b) for additional requirements.

The buffer distances are slope feet. For planning purposes the buffers created in GIS are horizontal distance which exceeds or meets the requirements.

There are other requirements for determining the buffers not displayed here. Examples are the Riparian Soils, High Hazard (slide) soils, crowns of trees that do not extend past slope breaks, and maintaining 50 percent natural shading on temperature sensitive lake systems. These types of requirements can extend the buffer zones upon site specific examination of the area.

Riparian Area Land Use Designation Widths for Estuaries and Beach Fringe

Beach Fringe 500 feet slope distance inland from average high tide. For planning purposes the buffers created in GIS are 500 feet horizontal distance, which exceeds or meets the requirement.

Estuaries 1,000 feet slope distance inland from average high tide. For planning purposes the buffers created in GIS are 1,000 feet horizontal distance, which exceeds or meets the requirement.

Status of Riparian Area Land Use Designations (RP's)

Stream sections were defined according to their characterisitics by the Alaska Region Channel Type Classification System, and are divided into nine basic river and stream process groups. The eight process groups occur in the Project Area. Table 3-24 displays the overall condition of RP's by process group when totaled for the North Revilla Project Area. This table shows the total length of stream and lake RP process groups.

Table 3-24
Status of Riparian Area Land Use Designation (RP's)

Stream Process Group	Total RP Miles	Total RP Acres
Estuarine	2.9	106
Palustrine	9.8	326
Floodplain	18.9	694
Alluvial Fan	19.3	606
Large Contained	1.6	51
Moderate Gradient Mixed Cont.	32.0	996
Moderate Gradient Cont.	18.7	524
High Gradient Contained	368.6	8,976
Lakes	22.1	1,932
Total	493.9	14,211

* Pre-TTRA acres harvested within RP's
SOURCE: Zellmer, 1993

Table 3-25 displays the amount of RP buffer area harvested before 1993 by VCU. Percent of the RP buffers harvested is displayed to show the impact on future supplies of LWD.

Table 3-25
Status of RP's by VCU

VCU	Total RP Acres	Acres* of RP Harvested Before 1993	Percent of RP Harvested Before 1993
732	323	0	0
733	1,775	232	13
735	924	141	15
736	1,499	412	27
737	1,506	537	36
738	2,587	738	29
739	2,988	421	15
740	608	145	24
Total	12,210	2,628	22

* Pre-TTRA acres harvested within RPs
SOURCE: ZELLMER 1993

Watersheds

There are more than 780 miles of streams within the Project Area. The Project Area can be categorized into a number of watersheds, or areas that contribute runoff water to a particular waterway. These categories enable biologists to evaluate various management activities on fish habitat and its capability to produce fish. Many watersheds in the Project Area contain streams that have no name other than the Alaska Department of Fish and Game Anadromous Stream Catalog number. For a summary of miles of stream in the Project Area, see Tables 3-21 and 3-24.

In addition to streams, the Project Area has approximately 1,535 acres of lakes and 434 acres of estuaries. These areas also provide high quality fish rearing habitat.

It is common for several species of anadromous salmon and trout to use the same reach of stream for migration, spawning, and rearing. Where resident fish occupy the same reaches of the stream as anadromous fish, the resident trout are not found in large numbers. Watersheds within the Project Area were identified as high quality sport fishing systems for cutthroat trout, including Traitors Creek and Orchard Lake system (FSH 2609.24). The Orchard lake system has also been designated by the Forest Service and Alaska Department of Fish and Game as a "Red Pin" watershed because of its high quality cutthroat fishery and recreational opportunities.

Klam Creek, located north west of Klu bay, laces a series of small lakes and muskegs through two short valleys. Pink, chum, and coho salmon are found up to a 20-foot

high waterfall 1.4 miles upstream. Cutthroat trout may be found throughout the system. Logging operations were conducted near the outlet in 1957 and has now grown into a thick cover of small trees.

Klu Creek empties into the head of Klu bay. It cuts through a valley that divides 0.6 miles upstream; the larger valley ascends northward through muskeg and small ponds. Most of the spawning area is limited to upper intertidal zone where pink and chum salmon take advantage of good spawning gravels. Coho salmon, Dolly Varden, cutthroat, and steelhead are found upstream. The stream outlet area was logged in 1956 with an additional entry made in 1987 into the western portion of the watershed.

Orchard Creek splits and cascades over a 200-foot high rock wall into the head of Shrimp Bay. The upper portion of the stream provides spawning areas for the cutthroat trout and kokanee fishery of the 962-acre Orchard lake. The watershed has not been logged.

On Neets Creek, a short distance (0.1 mile) above its outlet a 15-foot barrier falls blocks the migrating salmon from traveling upstream. Farther up stream, a southern branch leads to Neets Lake where cutthroat may be found. A little farther up the valley lies Bluff Lake, named for its steep sides. Originally a cutthroat lake with kokanee salmon, no kokanee have been caught for more than 10 years. Only in the short intertidal zone are there any spawning areas for pink, chum, and Dolly Varden. The two valley lake basins were extensively logged from 1957 through 1959.

Traitors Creek flows from high pond basins scattered along the west side of the Carroll River divide. Its three side branches join to form a small, eight-mile long river with flows as high as 200 cubic feet per second. The main stream flows gently through grass lined ponds used by cutthroat trout. Then it cascades over a three step, 75-foot high waterfall before traveling through a short quiet section, and plunges over a 15-foot high waterfall to flow to the sea. Within this final 1.1 mile section of the stream may be found the spawning beds for pink, chum, Dolly Varden, and steelhead trout. This stream is one of the more important natural spawning areas of Revillagigido Island and has been extensively studied from 1961 through 1972, when the National Marine Fisheries maintained a research station in the creek. The concentration of spawning salmon attracts large numbers of black bears that fish along the stream shores. The lower portion of the creek was logged in 1978 and 1979, while the upper valley tributaries were harvested in 1983 through 1984.

Margaret Creek watershed has more than 22 miles of stream, including Spike and Sprout Forks. Originating from a small unnamed lake 1,033 feet high on the Naha Divide, Margaret meanders nearly 3 miles, past beaver ponds into Margaret Lake, then down about 0.3 mile over a 30-foot high waterfall before continuing on to the sea. The Forest Sciences Laboratory began studies on non-anadromous resident salmon populations in Margaret lake in 1989 to assess the effects of installing a fish ladder (1990) and introducing anadromous salmon (1988 to 1992). To date cutthroat populations and size have increased, and coho have become established in the beaver ponds above the lake (Bryant and Frenett 1992). Coho, sockeye, pink, and chum salmon are now found along with Dolly Varden, cutthroat, and kokanee in Margaret Creek. The lower slopes of the watershed were harvested from 1962 to 1963 and in 1968 to 1969. This pre-TTRA harvest does not affect current spawning habitat. Table 3-26 summarizes additional information on these important stream systems within the Project Area and fish species found in them.

Table 3-26
Major Streams within the Project Area and Fish Species

VCU	Stream Name	Watershed Number	Anadromous Miles	Resident Miles	Watershed Acres	Fish Species
732	Klam Creek	C11A	0.2	6.9	4,745	Coho, Pink, Chum, Cutthroat
	Klu Creek	C13A	2.2	4.9	4,156	Coho, Pink Chum, Dolly Varden, Cutthroat Steelhead
733	Orchard Creek	C40C	0	7.6	5,075	Cutthroat, Kokanee
735	None					
736	None					
737	Neets Creek/ Bluff Lake	C41B C41B	0.8	8.2	7,646	Pink, Chum, Dolly Varden' Cutthroat
738	Margaret Creek/Lake	D57B	11.5	9.9	11,613	Pink, Chum, Coho, Sockeye, Dolly Varden, Cutthroat Steelhead, Kokanee, Rainbow
739	Traitors Creek	C60C C59B	1.1	25.0	16,287	Pink, Chum, Dolly Varden, Steelhead, Cutthroat
740	None					

SOURCE: Zellmer, 1993
Most other streams are short direct lines to the salt water

Habitat Capability

Large Woody Debris. Large Woody debris (LWD)—trees and tree pieces greater than four inches in diameter and 10 feet long—is one of the most important components of high quality fish habitat. Also known as Large Organic Debris (LOD), this material provides food and building materials for many aquatic life forms, provides cover for juvenile and adult fish, and is a primary habitat-forming element in some channel types.

The maintenance of woody riparian vegetation is important as a source of nutrient input. As debris accumulates in streams, it creates pools, traps nutrient-laden organic matter, and supports aquatic insects and other food items for fish. In Staney Creek, LWD decreased flows and increased the abundance of aquatic insects (Salo 1972). Shaheen Creek studies compared old-growth, buffered, and clearcut area effects on LWD and habitat characteristics, finding that LWD provided by buffer zones was able to support higher coho densities from summer through winter by protecting important winter habitat (Uberuaga 1983).

Gradual entry of LWD into the aquatic system is desirable to maintain stream habitat diversity and stability. Large amounts entering abruptly can be detrimental to the

aquatic ecosystem by becoming a physical barrier and causing bank erosion and channel migration problems. In most cases, however, gradual and consistent input of LWD is important to maintain stream productivity (Harris 1989).

Past management practices have reduced the total amount of large in-channel woody material in some streams on the Project Area. Prior to the enactment of TTRA, timber often was harvested to the edge of the streams, and stream cleaning operations were commonly conducted to prevent perceived fish passage problems. Cleaned streams have consistently shown lower over winter survival rates than unharvested or harvested-but-buffered streams (Heifetz et al. 1986, Bryant 1983, 1985, Bjornn et al. 1991).

Blowdown of Trees Blowdown of trees is a natural phenomenon in Southeast Alaska. There is evidence to show that blowdown does not occur randomly. Natural factors and shape of created openings determine the probability of blowdown occurring in adjacent stands (Harris, 1989; Moore, 1977). Site-specific fisheries mitigation measures such as timing, road crossings, and stream and lake protection zones are contained on the Unit Cards (Appendix K). These will be refined during field layout of the units to reduce blowdown hazard. In addition, the boundary of the retained vegetation may be moved away from the stream, to a maximum distance of the entire RP, to provide a windfirm zone. Some blowdown can contribute to the LWD needed to maintain instream habitat.

Stream Temperature Summer high and winter low water temperatures influence fish survival and condition. Water temperature affects the metabolic rate of aquatic organisms and can affect the migration timing of adult and juvenile fish. Small changes in water temperature can affect emergence of fry from the gravels and have a fairly large effect on eventual adult survival (Holtby and Scrivener 1989). Reductions in canopy cover may produce increased temperatures in summer and reductions in winter.

The shading of streams is important because direct-beam solar radiation is the primary factor influencing temperature change in summer. The effect of partial canopy removal is directly proportional to the reduction in canopy providing shade to the stream. Buffer strips along streams provide a relative degree of shading depending on a number of factors including vegetative structure and density. Another factor is the measure of the angle of the sun to the canopy and slope of the ground. Buffer strips with widths of 100 feet or more generally provide the same level of shading as that of an old-growth stand (Beschta et al. 1987). Harvest of streamside vegetation, as well as the total amount of harvest in a watershed, can affect water temperature. The Thorne River and salmon producing tributaries of the Staney Creek watershed stream temperatures were reported to "increase much more rapidly in logged than in unlogged study areas" due to streamside removal of vegetation. Rates of temperature increase in water temperature between similar study areas indicated 0.28 C/100 feet (0.50 degrees F) through logged areas and 0.02 C/100 feet (0.04 degrees F) through unlogged forest (Taylor and Gibbons 1973).

Timber harvest to the streambank is suspected of raising stream temperatures to a level which may contribute to adult fish kills, although no direct link has been established (Beak 1989, Konopacky 1991). Major streams in the Project Ares having past harvest on their banks are Klu, Neets, Traitors, and Margaret creeks. No fish kills due to temperature have been documented in the Project Area.

The TLMP Draft Revision has placed a threshold on commercial harvest on watersheds of less than 35 percent of their land area cut within the 15 years. This allows for recovery of the watershed and a reduction of stream temperature sensitivity before any additional harvest may take place within the watershed (USDA Forest Service 1991a). Temperature sensitive watersheds exceeding the 35 percent harvest within the 15-year limitation (35 percent limit) were not found within the Project Area . See the Water Resources section in this chapter for further discussion.

Continued sensitivity to temperature changes in streams may be a result of pre-TTRA harvest practices. These may continue until natural reforestation replaces the canopy cover. Temperature studies on Staney Creek, Prince of Wales Island, revealed that three-year regrowth of vegetation along stream banks after logging did not protect the stream from solar radiation (Salo 1972). Every effort will be made through application of TTRA, Riparian, and high mass movement index (MMI-4) soils buffers, in accordance with the Aquatic Management Handbook, to minimize effects of timber harvest and road construction on stream systems.

Low winter temperatures can lead to detrimental winter stream conditions, such as anchor ice formation and freezing of spawning gravels, which can reduce pool size. Low temperatures may be aggravated by removing streamside vegetation. However, estimating the effects is very difficult because of the influences of intermittent snow or ice cover and high variability in winter air temperature, and the influence of wind and precipitation patterns commonly found in Southeast Alaska.

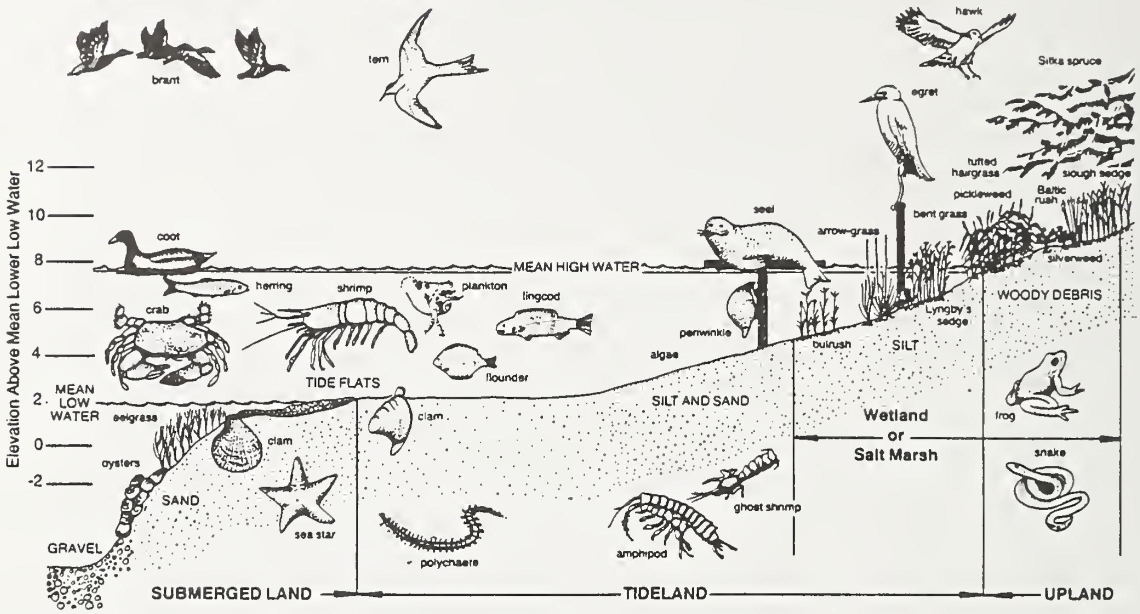
Sedimentation. Aquatic productivity can be influenced by the concentration of sediment in the water column and the amount of fine sediment introduced into spawning gravel. Direct impacts from sediment concentration include filling gravel pore spaces, which reduces water circulation necessary for fish egg and fry survival and growth. Sediment also retards emergence of the young fish after hatching. Young fish can die within the gravel if fine sediment blocks their movement through gravel to open water. During winter, young salmonids use spaces between gravel and rubble to escape the effects of low water temperatures and ice. When these spaces fill with sediment, the young fish must emerge from the gravel and use energy to maintain themselves in the current, reducing their ability to survive.

Suspended sediment may also irritate the mouth and gills of young fish and, if persistent, can erode the gills of larger fish. Such damage may increase fish stress, leading to increased susceptibility to disease. As rearing pools fill with sediment, rearing space is reduced, lowering habitat capability, and increasing stress and vulnerability to predators. Sediment indirectly affects fish by reducing populations of aquatic insects which are important fish food, increasing competition for food items, weakening unsuccessful feeders, and reducing the number of fish that can be produced from a stream section. Salmonids are generally sight feeders, and turbid water reduces their feeding efficiency.

Introduction of sediment can affect survival of fish eggs and newly emerged fry (aelvins). Therefore, road and fish-pass stream crossing construction activities and use of equipment in Class I streams are allowed to occur only when eggs or aelvin are not in the stream gravels. The allowed windows close when adult salmon enter stream systems to avoid disturbance during spawning. The windows for in-stream operations can vary slightly from stream to stream and site to site. Site specific fisheries and field information (including ADF&G recommendations) are used to determine the operating windows and will be applied to the Project Area. In the Ketchikan Administrative Area, the windows for allowed instream operations are generally established to be June

1 to August 7 for pink and chum salmon, June 15 to September 1 for coho salmon, and July 18 through August 7 for steelhead trout. However, these operations windows can vary from site to site within the stream system and throughout the Project Area. Site specific information on timing restrictions may be found in Appendix K, Unit Cards.

Physical factors contributing to fish habitat quality and quantity—including sedimentation, water chemistry, and streamflow regimes—see the Soils and Water Resources sections of this chapter.



—An estuary is a highly productive ecosystem with a diverse array of wildlife species.

Management Indicator Species

Management Indicator Species (MIS) are species whose population changes are believed to best indicate the effects of land management activities (USDA Forest Service 1982). Through the MIS concept, the total number of species occurring within a project area is reduced to a manageable set of species that collectively represent the complex of habitats, species, and associated management concerns. The MIS are used to assess the maintenance of population viability, changes in biological diversity, and effects on species in public demand.

In this EIS, Coho and Pink Salmon and Dolly Varden are the MIS used to evaluate the environmental consequences of the alternatives on fish habitat capability. The models are indicators of projected changes in habitat due to management practices. Their purpose is to assist in making determinations of comparisons between alternatives by management (see the Wildlife section in this chapter for further explanation). The results from the habitat capability models can not be interpreted as precise estimates of rearing fish biomass or actual fish production. Anadromous fish use of a variety of habitats and prior timber harvests in riparian stream bottoms or stream enhancement projects were part of the complexity of the fish habitat capability model.

Coho and Pink Salmon have been selected as MIS for anadromous fish species and represent two different phases of salmon life history: spawning/egg incubation and

Management Indicator Species (MIS)

Fish Management Indicator Species (MIS) for this EIS are:

- ✔ Coho Salmon
- ✔ Pink Salmon
- ✔ Dolly Varden Char

For a list of wildlife MIS, see the Wildlife section of this chapter.

fresh water rearing. Dolly Varden char was selected to represent resident species for the North Revilla Project Area. Anadromous fish spend at least part of their life in fresh water and part in salt water. Salmon lay their eggs in the stream gravels, and the juveniles hatched from the eggs emerge from the gravels. Depending on the species of the salmon, the amount of time the juveniles spend in fresh water is variable before maturing in the ocean. Resident trouts and chars spend all of their life in fresh water, spawning in stream bed gravels and growing to maturity in the streams and lakes of the area.

Coho Salmon Coho salmon are highly dependent on quality rearing habitat for their health, growth, fresh water survival, and marine survival. Coho juveniles spend an average of 2 years in fresh water streams and rivers, attaining a size of about 4 to 6 inches, before migrating to salt water, as out-migrating smolts. In the ocean, smolts mature in average of 2 years and reach 6 to 20 pounds and become important to the commercial troll and marine sport fishery of the area. An average of 1.67 million fish per year between 1979 and 1988 (Forest Service 1991a) were harvested in Southeast Alaska.

Because cohos spend more time in fresh water, habitat capability for this species is limited not only by the quantity and quality of spawning gravel, but also by the ability of the fresh water to support overwintering young salmon. Small lakes, backwater ponds, and pools formed by large woody debris provide this overwintering habitat (Irvine and Johnston 1992, Nickelson et al. 1992a, Nickelson et al. 1992b). In summer, relatively deep pools in small streams are preferred (Bugert 1991). Buffers (100 foot or greater, of stable, windfirm, old growth) along with RP's are designed to provide a continuous supply of LWD to maintain coho spawning and rearing areas.

Coho habitat capability on Table 3-27 represents the estimated potential for each VCU to produce salmon.

Table 3-27

Coho Habitat Capability Effects and Percent Change from 1954 to 1993.*

VCU	1954	1993	%
732	3,906	3,906	-0
733	54,970	54,964	-<1
735	79,412	79,412	-0
736	12,801	12,708	-1
737	18,263	17,535	-4
738	28,220	43,040*	+53
739	25,416	25,374	-<1
740	2,203	2,203	-0
Total	225,191	239,142	6

* Installation of the Margaret lake fish pass increased productivity.
SOURCE: Zellmer 1993

Pink Salmon Pinks (humpback) are the most widely distributed of the salmon. Pink salmon are important to the commercial fishery of Southeast Alaska, where they represent the greatest poundage harvested; an average of 85 million pounds were harvested between 1979 and 1988 (USDA Forest Service 1991a). Their juveniles go to sea immediately upon emergence from the gravels of coastal streams. Pinks mature in the ocean for 2 years before returning to spawn. Spawning gravel quantity and quality limits salmon spawning habitat capability. Spawning bed capacity has been evaluated in Indian Creek and the Harris River where most pink egg losses were found to increase as the density of female spawners increased (McNeil 1964). Changes in pink salmon fry and adult numbers are primarily due to predation from other fish, birds, and mammals, including humans. There is no empirical evidence in Southeast Alaska that pink salmon productivity has generally been affected by logging or road construction. Stream buffers and BMP's will mitigate most sedimentation problems. Ocean survival is influenced by food sources, predators, offshore and near shore commercial fish harvests, water temperatures, and many other factors. Table 3-28 represents the capability changes 1954 to 1993.

Table 3-28
Pink Habitat Capability Effects and Percent Change from 1954 to 1993

VCU	1954	1993	%
732	147,308	147,308	0
733	435,105	435,105	0
735	243,795	243,795	0
736	343,843	343,843	0
737	722,853	722,853	0
738	853,584	4,267,919	400
739	2,616,927	2,616,927	0
740	387,235	387,235	0
Total	5,750,650	9,164,985	59

SOURCE: Zellmer 1993

Dolly Varden Dolly Varden char were selected to represent resident fish habits because of their wide distribution, availability of data on the species' habitat requirements, and distribution over the full spectrum of resident fish habitats. Dolly Varden are also present in their anadromous form in the area.

Spawning gravel, water quality and quantity, water depth and velocity are important habitat components for Dolly Varden spawning and successful incubation of eggs to fry. Dolly Varden, like coho salmon, are highly dependent on quality rearing habitat for their health, growth, fresh water survival, and marine survival. Dolly Varden juveniles spend 1-4 years in fresh water before migrating to salt water, as out-migrating smolts. Dolly Varden habitat capability like coho habitat capability is directly influenced by LWD recruitment. Anadromous Dolly Varden habitat needs are much like that of the coho salmon, with the exception that some Dolly Varden may live their whole life in fresh water. Table 3-29 shows Dolly Varden habitat capability,

effects, and percent change from 1954 to 1993. Reductions in habitat capability in VCU's 733, 737, 738, and 739 due to previous harvesting practices may be offset by rehabilitation under Knudson-Vandenburg (KV) or other eligible funding for proposed projects on Traitors, Neets, and Margaret creeks. See Appendix I on Sale Area Improvement/KV Opportunities for further details.

Table 3-29

Dolly Varden Habitat Capability Effects and Percent Change from 1954 to 1993*

VCU	1954	1993	%
732	21,792	21,792	-0
733	146,920	146,879	-<1
735	37,705	36,946	-2
736	55,986	55,092	-2
737	77,388	72,430	-6
738	104,658	98,907	-6
739	84,599	84,247	-<1
740	14,630	14,524	-1
Total	543,678	530,817	-2

SOURCE: Zellmer 1993

Deep, quiet pools are migratory holding areas where adult salmon school to rest.

Effects of the Alternatives

Legal and Management Requirements

The TTRA provides direction for fisheries protection in section 103(a). The objective of this section of TTRA is to assure the protection of riparian habitats and to protect fisheries through the application of buffer zones not less than 100 feet on Class I and some Class II streams in width and through the application of BMP's. The Act reads:

> (a) Section 705 (16U.S.C. 539d) of ANILCA is amended by adding at the end thereof the following new subsection: "(e) In order to assure protection of riparian habitat, the Secretary shall maintain a buffer zone of no less than one hundred feet in width on each side of all Class I streams in the Tongass National Forest, and on those Class II streams which flow directly into a Class I stream, within which commercial timber harvesting shall be prohibited, except where independent national forest timber sales have already been sold..... The Secretary shall use best management practices, as defined in the Region 10 Soil and Water Conservation Handbook (FSH 2509.22), January 1990, to assure the protection of riparian habitat on streams or portions of streams not protected by such buffers zones. For the purposes of this subsection, the terms Class I streams and Class II streams means the same as they do in the Region 10 Aquatic Habitat Management Handbook (FSH 2609.24), June 1986."

The National Forest Management Act (NFMA) sets the minimum standard for fish habitat protection on all national forests. The Tongass Timber Reform Act (TTRA) further provides specific direction for fish and riparian protection for the Tongass National Forest.

The NFMA regulations requires that no serious and adverse effect occurs to fish habitat; NFMA (36 CFR 219.27 (e)) states, in part:

> "No management practices causing detrimental changes in water temperature or chemical composition, blockages of water courses, or deposits of sediment shall be permitted within these areas [riparian areas] which seriously and adversely affect water conditions or fish habitat."

The TLMP Draft Revision (1991a) incorporates by reference the streams and lakes standards and guidelines. (see Appendix C for RP prescriptions)

Buffers are assigned to streams based upon both stream class and channel types. The guidelines for these buffers are contained in the Supplement to the Draft Forest Plan Revision. By considering both stream class and channel type additional buffers or other protection measures can be specified in order to maintain or enhance fish habitat and water quality. In no case are buffers being considered which are less than those required by TTRA.

The interdisciplinary team (IDT) used the Forest Plan Revision Standards and Guidelines for riparian protection to establish the TTRA buffers, additional no-cut buffers, and additional partial cut buffers. This was done for each inventoried stream based on its stream class and channel type. The IDT then overlayed these buffers with the potential units. They then examined the air photos to expand buffers to account

for windfirmness, logical units, and small slivers between buffers. During layout, if additional streams are found, the same standards and guidelines are used to establish buffers for each stream based on its stream class and channel type.

The Tongass Timber Reform Act Section 103(e) specifies "...maintain a buffer zone of no less than 100 feet in width on each side of all Class I streams in the TNF, and on those Class II streams which flow directly into a Class I stream, within which commercial timber harvesting shall be prohibited..." The Aquatic Habitat Management Handbook (FSH 2609.24) prescribes management practices for those streams not addressed by statute.

In a memo to District Rangers dated December 31, 1992, the Forest Supervisor directed that actions be taken immediately to ensure that all TTRA buffers meet the minimum 100-foot width, or the minimum width prescribed to meet the standards and guidelines for the streams when the buffer is greater than 100-feet in width. These acts include a quality control program to ensure accurate measurement of the minimum buffer width and length, statistically random sampling techniques to monitor the TTRA units, and finally, training personnel to fully implement TTRA. The District Ranger will be held fully accountable for proper implementation of TTRA requirements. Monitoring will focus on concerns about application and adequacy of buffer prescriptions.

Direct, Indirect, and Cumulative Effects

Fish Habitat

Timber harvest has potential positive and negative effects on fish habitat capability. Timber harvest may affect the sources of large woody debris, stream stability, water flow, and quality. These effects may be mitigated by Riparian LUD's (RP), High Mass Movement Soil (MMI 4), and TTRA buffer requirements. Timber harvest, under some circumstances, may have a positive effect on fish by increasing the amount of primary productivity in a stream system. However, these potential positive effects, which are generally only seasonal in nature, may be diluted by increased flows and are not quantified in this assessment.

Objectives for management affecting fish habitat in this EIS include:

1. Maintain or improve fish habitat capability in channel process groups.
2. Maintain natural stream bank and stream channel processes.
3. Maintain natural and beneficial quantities of large woody debris (LWD) over the short and long term.
4. Maintain water quality to provide for fish production.
5. Maintain optimum water temperatures for salmonids, considering both winter and summer habitat requirements, climate, and natural watershed characteristics.
6. Maintain or improve primary or secondary stream biological production in second-growth forest.
7. Maintain fish passage through stream crossing structures.

The timber harvest as proposed will have no significant reduction on fish habitat capability from the NRPA alternatives, regardless of which alternative is selected (see Tables 3-30 to 3-32). Class I, II, and III streams will not change with any of the alternatives. The habitat capability models predict that there would be an increase in coho capability of 6 percent (from 225,191 smolts in 1954 to 239,142 smolts in 1996). This increase is due to the Margaret Creek fish ladder constructed in 1989.

The increase of 59 percent in pink salmon habitat capability is also attributed to the Margaret Creek enhancement. Dolly Varden inhabiting Class I streams and Class II streams that flow directly into Class I streams will not be significantly affected by commercial timber harvest alternatives. The Dolly Varden Habitat Capability Model predicts a 2.7 percent decrease in habitat capability (from 543,678 smolts in 1954 to 528,816 smolts in 1997). There is not a significant change in habitat capability with regards to which alternative is selected.

The direct effects on fish habitat capability is common to all alternatives. Direct, indirect, and cumulative changes in fish habitat capability seen in Tables 3-30, 3-31, and 3-32 are due to past harvest activities.

Table 3-30
Coho Habitat Capability Effects and Percent Change from 1954 to 2140*

VCU	1954	1993	%	1997	%	2004	%	2140	%
732	3,906	3,906	-0	3,906	-0	3,906	-0	3,906	-0
733	54,970	54,967	-<1	54,964	-<1	54,960	-<1	54,948	-<1
735	79,412	79,412	-0	79,412	-0	79,412	-0	79,412	-0
736	12,801	12,728	-<1	12,708	-<1	12,676	-1	12,628	-1
737	18,263	17,606	-4	17,535	-4	17,421	-5	17,292	-5
738	28,220	43,250	53	43,040	53	42,700	51	42,179	49
739	25,416	25,384	-<1	25,374	-<1	25,358	-<1	25,322	-<1
740	2,203	2,203	0	2,203	-0	2,203	-0	2,203	-0
Total	225,191	239,456	+6	239,142	+6	238,636	+6	237,890	+6

* Includes lake production
Note: % = Percent difference between 1954 and indicated year
SOURCE: Zellmer 1993

Table 3-31
Pink Habitat Capability Effects and Percent Change from 1954 to 2140*

VCU	1954	1993	%	1997	%	2004	%	2140	%
732	147,308	147,308	0	147,308	0	147,308	0	147,308	0
733	435,105	435,105	0	435,105	0	435,105	0	435,105	0
735	243,795	243,795	0	243,795	0	243,795	0	243,795	0
736	343,843	343,843	0	343,843	0	343,843	0	343,843	0
737	722,853	722,853	0	722,853	0	722,853	0	722,853	0
738	853,584	4,267,919	+400	4,267,919	+400	4,267,919	+400	4,267,919	400
739	2,616,927	2,616,927	0	2,616,927	0	2,616,927	0	2,616,927	0
740	387,235	387,235	0	387,235	0	387,235	0	387,235	0
Total	5,750,650	9,164,985	+59	9,164,985	+59	9,164,985	+59	9,164,985	59

* Includes lake production
Note: % = Percent difference between 1954 and indicated year
SOURCE: Zellmer 1993

Table 3-32
Dolly Varden Habitat Capability Effects and Percent Change from 1954 to 2140*

VCU	1954	1993	%	1997	%	2004	%	2140	%
732	21,792	21,792	-0	21,792	-0	21,792	-0	21,792	-0
733	146,920	146,879	-<1	146,837	-<1	146,769	-<1	146,593	-<1
735	37,705	36,946	-2	36,836	-2	36,615	-3	36,413	-3
736	55,986	55,092	-2	54,811	-2	54,272	-3	53,488	-4
737	77,388	72,430	-6	71,886	-7	70,438	-9	70,384	-9
738	104,658	98,907	-6	98,075	-6	96,595	-8	94,774	-9
739	84,599	84,247	-<1	84,086	-<1	83,824	-1	83,300	-2
740	14,630	14,524	-<1	144,493	-1	14,443	-1	14,349	-2
Total	543,678	530,817	-2	528,816	-3	524,748	-3	521,093	-4

* Includes lake production
Note: % = Percent difference between 1954 and indicated year
SOURCE: Zellmer 1993

Riparian LUD

With increased developmental activities there is an added risk of unplanned stream-habitat impacts (such as accelerated numbers of landslides over background levels, blowdown of leave strips, and the subtle impacts that may result from stream reactions to rain-on-snow events), and cumulative effects of many small but individually insignificant actions affecting the RP zone. Harvest on MMI 3 (high mass movement index) soils, miles of road construction and reconstruction, and the number of stream crossings, are indicators of potential increased risk that may temporarily affect the sources of LWD, stream stability, and water quality. However, BMP's, Alaska State and Federal regulations and requirements will be complied with or exceeded to minimizes these effects.

There will be no timber harvest within TTRA buffers other than incidental right-of-way clearing associated with stream crossings or skyline corridors. Harvest is authorized within RP's. Table 3-33 displays the harvest activities within RP's for each alternative.

Table 3-33
Acres of Total Harvest in RP Buffers by Alternative

VCU	Alternative 1	2	3	4	5	6
732	0	0	0	0	0	0
733	0	9	0	1	29	1
735	0	0	0	0	0	0
736	0	0	0	0	0	0
737	0	0	0	2	2	0
738	0	0	0	0	0	0
739	0	43	62	16	46	52
740	0	0	0	0	2	0
Total	0	52	62	19	79	53

SOURCE: Zellmer, 1993

For a comparison, Table 3-34 shows the total amount of acres of harvest for road construction clearings in TTRA and RP buffers for each alternative including planned roads in cut and no-cut prescription zones.

Table 3-34
Acres of Total Harvest in TTRA and RP Buffers by Alternative

VCU	Alternative 1	2	3	4	5	6
732	0	23	0	0	22	0
733	0	10	3	3	9	3
735	0	11	8	9	8	8
736	0	7	7	6	3	7
737	0	5	1	4	3	1
738	0	6	5	1	5	3
739	0	3	4	0	6	4
740	0	0	0	0	2	0
Total	0	65	28	23	58	26

SOURCE: Zellmer, 1993

Temperature Sensitive Streams

All watersheds with in the Project Area meet the TLMP Draft Revision standards and guidelines for temperature sensitivity by limiting harvest to 35 percent of the watershed land base within a 15-year period. Implementation of any of the alternatives under consideration would not exceed this threshold.

Individual units were analyzed for their potential effects on temperature sensitive tributaries. While required TTRA buffers will mitigate most temperature sensitivity concerns, there still is concern about providing topographic shading to Class III streams that flow through harvest units. Table 3-35 lists units that have characteristics that may contribute to the temperature sensitivity of nearby streams. These characteristics include one or more of the following: south-facing slopes, lack of immediate downstream forested stream buffers, historical and continued harvest activities, shallowness, flow, adjacency to ponds or muskegs, and fish production (FSH 2609.24 Appendix 4). Potential stream impacts will be mitigated by leaving all trees less than 12 inches DBH within 35 feet of Class III streams to provide shading and protection.

Table 3-35
Units Having a Potential to Increase Temperature Sensitivity of Nearby Streams

Units	Alternative(s)				
3004	2				
3006	2	3	4		6
3007	2		4	5	6
3015	2				
3016		3			6
3021		3			6
3022		3			
3035			4	5	
3037			4		
4007			4	5	
6026		3			
8046	2			5	
8057		3			6
8062		3			

SOURCE: Zellmer 1993

Aquatic Habitat Research Within the NRPA Project Area

The Forestry Sciences Laboratory began studies of the resident salmon populations in Margaret Lake in 1989. The purpose of the study was to determine the status of the resident fish populations in the lake before a fish ladder was constructed that would allow colonization of the lake by several species of anadromous salmonids. The long-term goal of the study is to describe the effects of introducing anadromous salmonids into non-anadromous watersheds and to examine the effectiveness of stocking sockeye salmon fry into lakes with resident trout. A series of studies have been initiated to investigate ecological interactions among species and habitat utilization as juvenile anadromous salmon exploit the lake and stream basin. A progress reports for 1991 and 1992 are in the Planning Record.

Units in or near the research area were designed to maintain maximum RP buffers and minimize sediment delivery to beaver ponds. The lower portion of unit 8016 was dropped because of the large RP buffers, leaving approximately 800 feet between the cut and the beaver dam area. Unit 8012's northern boundary follows the ridge so that no cutting is planned on the steep lake side of the hill. No impact on the research area is anticipated at this time because of either unit design or appropriate implementation of RP buffers.

Fish Project Opportunities

Knudsen-Vandenburg (KV) Funds made available from timber sale receipts can be used for projects that enhance non-timber resources in the project area. Currently identified potential fish habitat rehabilitation projects include work in Traitors, Neets, and Margaret Creeks. Additional opportunities to work in stream reaches affected by past management activities exist in many other smaller project area watersheds. The projects will require additional NEPA analysis prior to implementation. Maintenance and monitoring will be established on approved KV funded projects.

There are also opportunities to improve access, interpretive education on, and utilization of the Project Area recreational fisheries through KV funds, such as on Orchard Lake.

Table 3-36 displays the annual pounds of fish in commercial harvest that could be contributed through implementation of the projects.

Table 3-36

Fisheries Enhancement Estimated Contribution in Pounds of Commercial Fish

Salmon	Pounds of Fish	Number of Fish
Coho	9,130	1,100

SOURCE: Ketchikan Area 10-Year Summary Table, May 1993/Medel, July 1993.

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WILDLIFE

Key Terms

Carrying capacity - the maximum number of a wildlife species that a certain area will support through the most critical period of the year
Habitat - the sum total of environmental conditions of a specific place that is occupied by an organism, population, or community of plants or animals
Habitat capability - an estimated number of animals that a habitat can sustain
Management Indicator Species (MIS) - species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities
Viable population - the number of individuals of a species required to ensure the long-term existence of the species in natural, self-sustaining populations adequately distributed throughout their region
Wildlife Analysis Area (WAA) - divisions of land used by the Forest Service that correspond to Minor Harvest Areas used by Alaska Department of Fish and Game

Affected Environment

Alaska's wildlife are valuable for aesthetic, economic, recreational, ecological, and subsistence reasons. Over 350 species of mammals, birds, amphibians, and reptiles occur on the Tongass National Forest, and most of these except goat and brown bear can be found in the North Revilla Project Area. They occupy a diverse range of land types and plant communities, and are variably adapted to climatic extremes, change in habitat, predation, and hunting pressure.

Management Indicator Species (MIS)

Management Indicator Species (MIS) are species of vertebrates and invertebrates whose population changes are believed to best indicate the effects of land management activities (USDA Forest Service 1982). Through the MIS concept, the total number of species occurring within a Project Area is reduced to a manageable set of species that collectively represent the complex of habitats, species, and associated management concerns. The MIS are used to assess the maintenance of population viability (the ability of a population to sustain itself naturally) and biological diversity, and to assess effects on species in public demand (TLMP Draft Revision 1991a).

The following have been selected as Management Indicator Species for this project and will be discussed in detail in this chapter:

Species	Rationale for Selection
Sitka black-tailed deer	Important game species
Marten	Old-growth; important furbearer
Black bear	Represents estuarine habitat; game species
Bald eagle	Old-growth coastline; high public interest
River otter	Represents riparian habitat; furbearer
Hairy woodpecker	Cavity excavator
Brown creeper	Represents large, high volume, old-growth trees
Red squirrel	Utilization of old-growth and second growth
Vancouver Canada goose	Represents riparian habitat; game species
Gray wolf	In response to public comment on North Revilla DEIS

The following species were selected as Tongass National Forest Management Indicator Species, but have not been selected as MIS for the North Revilla project:

Species	Rationale for Nonselection
Red-breasted sapsucker	Adaptable and abundant in Project Area
Brown bear	Does not occur in Project Area
Mountain goat	Does not occur in Project Area-limited habitat due to geology and topography

Wildlife Analysis Areas (WAA's)

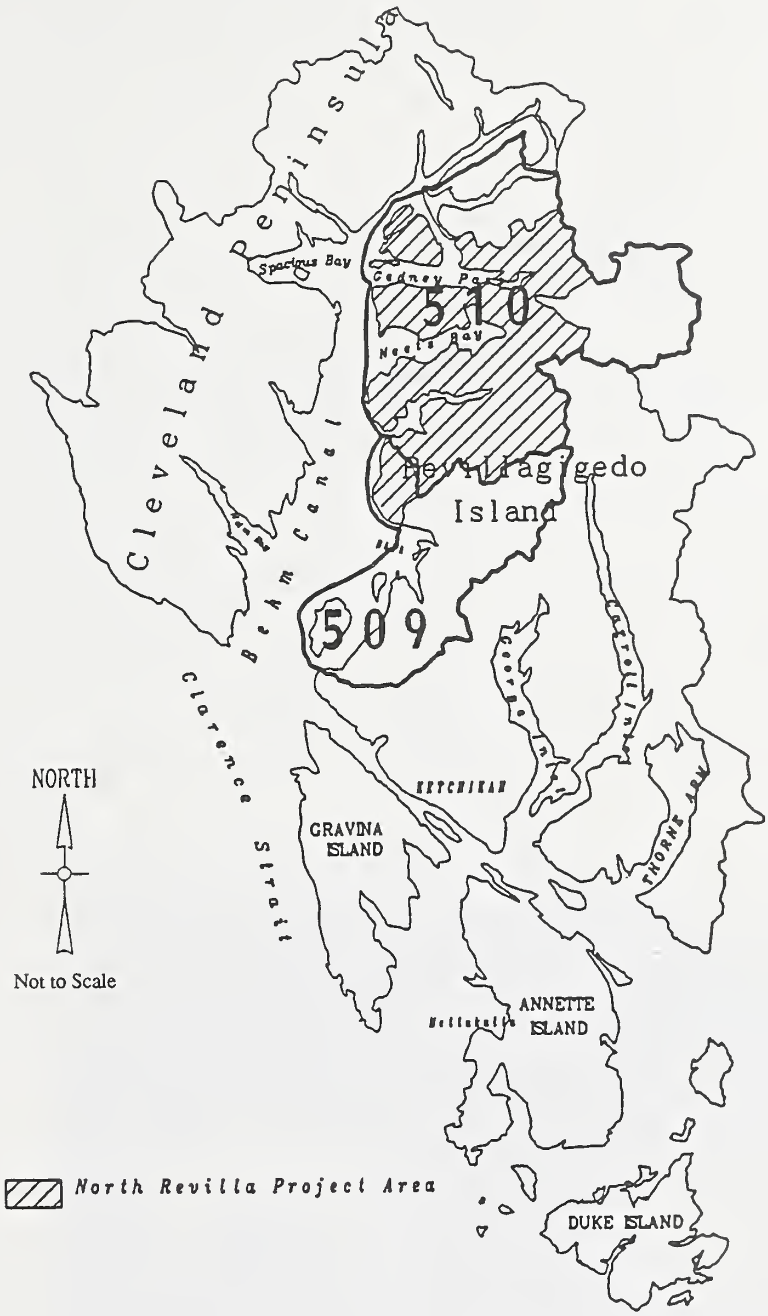
Wildlife Analysis Areas (WAA's) represent divisions of land that the Alaska Department of Fish and Game (ADF&G) uses for data collection purposes, and the Forest Service uses for wildlife analysis purposes. WAA's included in the North Revilla Project Area are 509 and 510 (Figure 3-3). Specific VCU's that are included within Project Area WAA's are listed in Table 3-37. See the Subsistence section of this chapter for a further analysis of wildlife species by WAA.

Table 3-37
VCU's Within Wildlife Analysis Areas (WAA's) and Percent of the WAA that Includes the Project Area

WAA	% of WAA in Project Area	VCU's
509	10	740
510	67	732, 733, 735, 736, 737, 738, 739

SOURCE: Matson, 1993. Data derived from GIS data base.

Figure 3-3
Wildlife Analysis Areas



Wildlife Analysis Areas (WAA's) are divisions of land identified by ADF&G and used by the USDA Forest Service for wildlife analysis.

Major Habitat Categories

The following categories are types of environment in which a species occurs. The environment can be described in physical or biological terms, which often includes elevation, topography, and type of vegetative community. A species may occupy a range of different habitats or more than one distinct kind of habitat in different seasons. Terrestrial habitats in the North Revilla Project Area include:

— Beach fringe
— Estuary fringe
— Riparian
— Forest
    Old-growth forest
    Second-growth forest
— Alpine/subalpine
— Muskeg (Peatlands)

A brief description of these habitats follows. Table 3-38 displays an acreage inventory of each habitat by Wildlife Analysis Area (WAA). Note that because several categories overlap each other (e.g., beach fringe may contain some old-growth and some riparian habitats), the sum of the total acres will not be the same as the total acreage announced for the Project Area.

Table 3-38
Major Habitat Categories in the Project Area, 1993 (by Wildlife Analysis Area), in Acres*

WAA	Beach Fringe	Estuary Fringe	Old-Growth Forest	Second Growth Forest	Total Commercial Forest	Alpine Subalp	Riparian	Muskeg
509	401	4	3,397	1,261	4,658	780	682	696
510	4,563	2,143	53,530	16,352	69,882	16,191	14,213	11,693
Total	4,964	2,147	56,927	17,613	74,540	16,971	14,895	12,389

*Certain use areas overlap. For example, old-growth and second-growth forest are also included in beach fringe and estuary fringe habitats.

Beach Fringe

For the purposes of this analysis, beach fringe is the land within 500 feet of the mean high tide and excludes estuarine habitats. Areas within 500 feet of the ocean shoreline are transitional zones between land and water, salt and freshwater, and vegetated and nonvegetated conditions (USDA Forest Service 1979a). Forested areas in this transitional zone are heavily used by species with high economic, recreational, subsistence, or aesthetic values. Black bear, river otter, bald eagle, marten, black-tailed deer, and Vancouver Canada goose concentrate their activities during some seasons in these forest stands. Past timber harvest activity was concentrated in this habitat. No alternatives in the North Revilla EIS propose any additional timber harvest within beach fringe.

Estuary Fringe

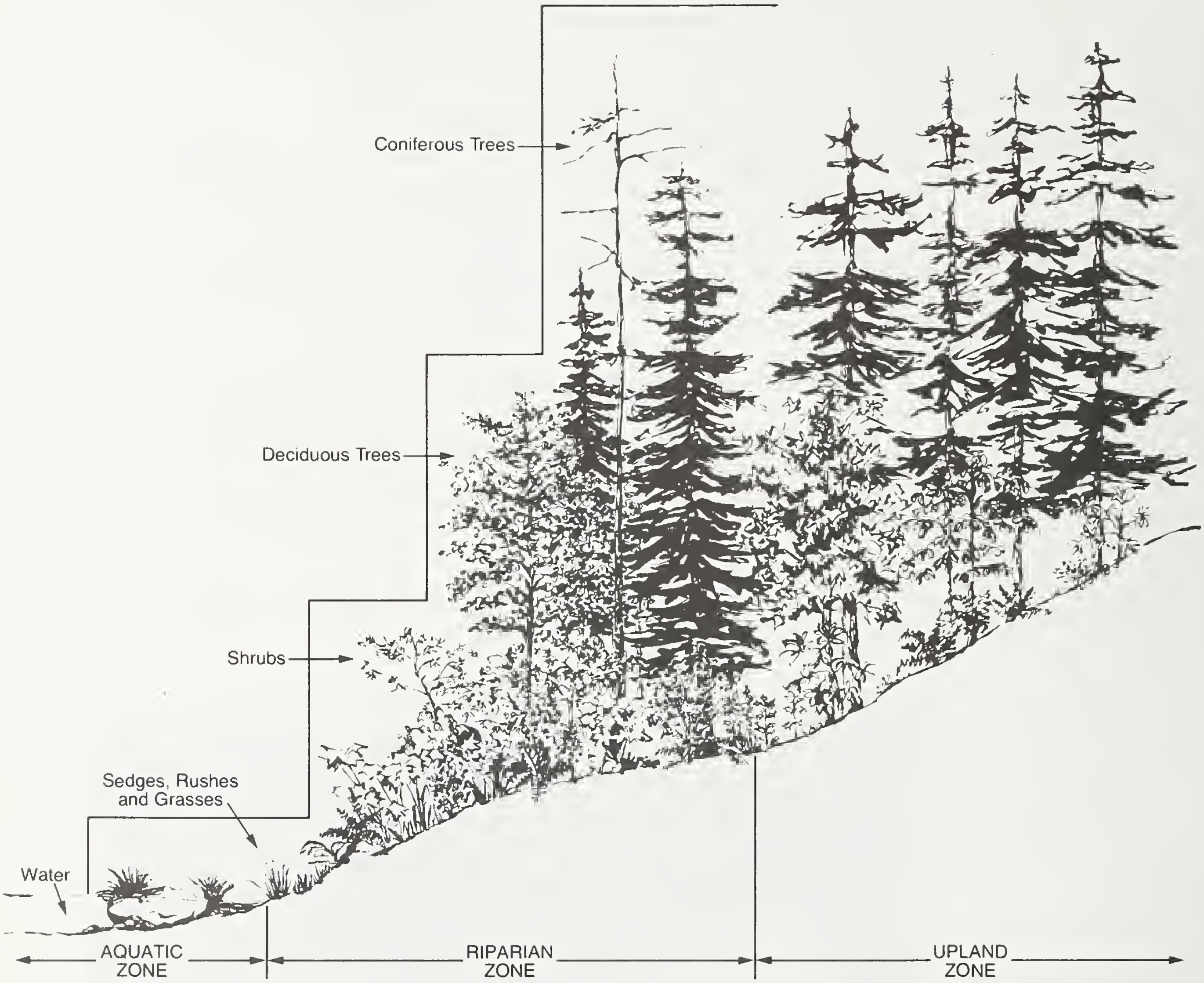
Estuary fringe habitat is a 1,000-foot zone around estuaries. Bears, waterfowl, furbearers, and eagles are the primary users of the estuary fringe habitat. The estuary fringe is similar to beach fringe, but because of species diversity, it has a greater value to wildlife, especially black bears, river otters, mink, bald eagles, and waterfowl. No harvest is proposed for harvest within the estuary fringe.

Riparian

The riparian habitat is recognized as some of the most productive wildlife habitat in Southeast Alaska. It occurs along rivers and streams or around inland lakes, and contains elements of both aquatic and terrestrial ecosystems. Many wildlife species use riparian zones disproportionately more than other areas (USDA Forest Service 1985), and riparian habitats are extremely important for eagles, furbearers, and black bears (USDA Forest Service 1986). Riparian areas are important migration routes for some wildlife species, and serve as travel routes for numerous species because of the presence of water, food, and cover.

Alternatives described in this EIS do not propose any harvest adjacent to Class I or II streams or lakes larger than 5 acres, except for road construction; the width of all proposed buffer strips is at least 100 feet. For additional information see the Soils and Fisheries sections of this chapter.

Figure 3-4
Riparian Area Characteristics



Riparian zones are transitional between aquatic and upland zones (which include forested wetlands). They provide water, food, and cover important for many wildlife species.
SOURCE: USDA Forest Service 1985.

Forest

Forest habitat includes all areas with forest cover, including old growth and second growth described below, and noncommercial forest land as described in the Silviculture Timber and Other Vegetation section of this chapter. Many wildlife species, including those associated with old-growth stands, use all forested areas within the Project Area.

Old-growth Forest

Old-growth forest is characterized by stands of trees usually well past the age of maturity with declining growth rates and signs of decadence, such as dead and dying trees, snags, and downed woody material. The stand usually includes large diameter trees, multi-layered canopies, a range of tree diameter sizes, and the notable presence of understory vegetation. These and other characteristics make old-growth forests important habitat for Sitka black-tailed deer, martens, black bears, and cavity nesting birds such as the hairy woodpecker. These forests are in a dynamic, steady state where the death of old trees is balanced by the growth of new trees. Old-growth forest acres are also included in beach fringe, estuary fringe, riparian, and other habitat areas. For a more detailed discussion of old-growth vegetation, see the Silviculture, timber and other vegetation, and Biodiversity sections of this chapter.

Second-growth Forest

Second-growth forest is defined for the purposes of this section as consisting mostly of areas that have been harvested. Large-scale second-growth stands are of lower value to wildlife such as deer, martens, bears, and cavity nesters. Conifer seedlings aggressively invade and eventually shade out desirable herbaceous vegetation and provide fewer trees and snags suitable for excavation by woodpeckers and other cavity users. This habitat type was inventoried to help display the amount of past timber harvest activity that has occurred within the North Revilla Project Area. Some second-growth forest has been created naturally by windthrow, landslides, and avalanches.

Alpine/Subalpine

The alpine/subalpine category includes all stands at or above treeline, including open meadows of grasses, forbs, and shrubs; and scrub forest (Sidle and Suring 1986). Subalpine habitat includes a mosaic of forested, scrub, and nonforested stands that occur at higher elevation than the upland forest, at the lower edge of the alpine zone (Sidle and Suring 1986). Alpine/subalpine habitat within the North Revilla Project Area is generally above 2,000 feet in elevation. These habitats are important summer foraging areas for deer and black bears.

Muskeg (Peatlands)

Muskegs are most often characterized by stunted yellowcedar and shore pine, along with sedges and other bog vegetation. Muskegs dominated by sphagnum moss or tall sedge cover smaller areas. The water table is at the surface, and numerous small ponds are scattered throughout the muskeg.

Wildlife Habitat Capability Models

Wildlife models were used to calculate habitat capability for each Management Indicator Species (MIS) in the Project Area. For specific information on the models used, see Appendix B of the TLMP Draft Revision(1991a). Because of the amount

Management Indicator Species (MIS)

Wildlife Management Indicator Species (MIS) for the North Revilla EIS are:

- ✔ Sitka Black-tailed Deer
- ✔ Marten
- ✔ Black Bear
- ✔ Bald Eagle
- ✔ River Otter
- ✔ Gray Wolf
- ✔ Hairy Woodpecker
- ✔ Brown Creeper
- ✔ Red Squirrel
- ✔ Vancouver Canada Goose

For a list of fish MIS, see the Fisheries section of this chapter.

of timber harvest on non-National Forest System lands throughout the Ketchikan Administrative Area, a maximum potential impact was assumed, and no habitat capability was calculated for state, private, or encumbered lands. There are 330 acres of private land and 440 acres of unconveyed State Selection land within the 109,520-acre Project Area (see Land Adjustments, Uses and Permits section of this chapter). Non-national forest and encumbered lands are less than 1 percent of the Project Area and therefore are not significant to the effects analysis.

The terms "habitat capability" and "populations" are not interchangeable. Habitat capability is synonymous with carrying capacity or the estimated number of animals the habitat can support through the most critical period of the year. Population is the estimated number of animals actually present at a given time. Populations may temporarily exceed habitat capability (for example, due to a series of mild winters). However, populations may be below what the habitat is capable of producing, due to predation, winter mortality, or other ecological factors in some years.

Given data limitations, the complexity of ecological relationships, and the need to simplify variables for use in the models, actual population sizes in some areas may vary considerably from those predicted by the analysis. However, the procedures provide estimates of habitat capability that over time are expected to be a reasonable indicator of population trends as they relate to the amount and quality of habitat only. Actual populations at any given point in time can be greatly influenced by weather, hunting, trapping, disease, predation and related factors. Table 3-39 estimates the 1954 and the current (1993) wildlife habitat capability in the Project Area.

Table 3-39
Wildlife Habitat Capability within the North Revilla Project Area

Selected MIS	1954*	1993*	Percent Change
Sitka black-tailed deer**	3,206	1,700	-47
Marten**	160	144	-10
Black bear	187	182	- 3
Bald eagle	233	137	-41
River otter	75	66	-12
Red squirrel**	76,774	70,793	- 8
Hairy woodpecker**	1,470	1,051	-28
Brown creeper**	3,526	1,338	-62
Vancouver Canada goose	269	243	-10
Gray Wolf	8	4	-50

* Habitat Capability for just the portion of WAA's in the Project Area.
** Patch-size Effectiveness calculations are displayed in the Biodiviersity section
SOURCE: Matson, 1993. Data derived from GIS data base and interagency habitat capability models.

Sitka Black-tailed Deer

The Sitka black-tailed deer was chosen as an MIS because it is an important game and subsistence species and is seasonally associated with old-growth forests.

Historically, population fluctuations of Sitka black-tailed deer in Southeast Alaska have been linked with winter severity (Merrian 1970) and predation pressure (Van Ballenberge and Hanley 1984). Deep snow and late springs associated with severe winters have occurred several times in the past 80 years. Deer die-offs are common during severe winters, even in the best old-growth winter ranges. Predators of deer—gray wolves, bears, and hunters—can also contribute to the population decline during these winters, inhibiting subsequent recovery of the deer population. In general, winter severity increases with latitude and with a decreased maritime influence in Southeast Alaska (Longhurst and Robinette 1981); within the Project Area, VCU's 732, 733, 737, and 739 have deep snow depth ratings, and VCU's 735, 736, 738, and 740 have moderate snow depth ratings.

Research conducted throughout Southeast Alaska, indicates that high volume, old-growth forests at lower elevations are essential to maintaining a sustainable deer populations during severe winters (Schoen et al. 1985; Hanley and Rose 1987; Yeo and Peek 1992)). Large, strong branches characteristic of the old-growth stands intercept snow, providing for deer mobility while maintaining available forage. High volume stands of old-growth forests support adequate herb and shrub layers of deer forage. In most cases, timber harvest of deer winter range reduces the long-term quality of deer winter range. Effects on deer populations are compounded by the combination of deep-snow winters and large amounts of deer winter range converted to second growth. Snow significantly reduces forage availability in clearcuts during the winter. Closed canopy second-growth stands provide little forage in winter or summer. The amount of second growth and winter severity are key factors in determining the capability of the land to support deer populations.

An interagency model (Suring et al. 1991) was developed to evaluate the potential quality of winter habitat for Sitka black-tailed deer. Winter is assumed to be the most limiting season for the Sitka black-tailed deer throughout the area (Hanley and McKendrick 1985, cited by Suring et al. 1991). The deer model incorporated the following factors in the analysis: (1) snow conditions, (2) presence of predators, (3) physiographic features including aspect and elevation, (4) patch size and (5) vegetational characteristics including: (a) volume class of old growth, (b) forest type, (c) second growth (25–150 years), and (d) clearcut (0–25 years).

Results of the deer model indicates there is a habitat capability for approximately 1,700 deer in the North Revilla Project Area (Table 3-40). This represents a 47 percent reduction in habitat capability since the start of the KPC contract in 1954 because of past timber harvest. Table 3-40 shows habitat capability by WAA at current conditions and before 1954.

Table 3-40
ADF&G Population Objectives and Deer Habitat Capability by WAA for 1954 and 1993 in the North Revilla Project Area and for the Entire WAA

WAA	ADF&G Population Objectives	1954 Habitat Capability		1993 Habitat Capability		Percent Change	
		Project Area	Entire WAA	Project Area	Entire WAA	Project Area	Entire WAA
509	1,090	252*	1,454	162*	1,385	-36*	- 5
510	1,947	2,954*	2,652	1,538*	1,947	-48*	-27
Total	3,037	3,206*	4,106	1,700*	3,332	-47*	-19

* Numbers do not incorporate Patch-size Effectiveness calculations.
SOURCE: Matson, 1993. Data derived from GIS data base and Sitka black-tailed Deer Habitat Capability Model, Suring et al, 1992.

Deer Population Objectives

The Alaska Department of Fish and Game (ADF&G) has established deer population objectives for all WAA's in Southeast Alaska for the years 1991-1995. The population objectives for the individual WAA's can be found in "Population Objectives–Strategic Plan for Management of Deer in Southeastern Alaska 1991-95" (ADF&G 1991).

Deer population objectives for the WAA's range from maintaining deer habitat at 100 percent of the 1954 level, to 75 percent of the 1954 level. The existing habitat capability for deer in WAA 509 is well above ADF&G population objectives. The population objective for WAA 510 has been set at the current habitat capability (due to past timber harvest activity), which means that any additional timber harvest activity will reduce the habitat capability of WAA 510 below ADF&G population objectives (See Table 3-132 in the Subsistence Section). A complete analysis of how projected Forest-wide timber harvest levels affect deer habitat capability compared to the ADF&G population objectives can be found in the TLMP Draft Revision (1991a).

Marten

The marten was selected as an MIS to represent old-growth associated species and because it is an important furbearer. Marten populations are moderate in the Project Area. Trapping pressure is moderate from residents of Neets Bay and the Ketchikan area. High pelt prices, susceptibility to trapping pressure, and liberal trapping regulations have created a large demand for marten.

Martens prefer mature old-growth forests with a well developed overhead canopy. Most snags and downed woody debris are important to martens for winter and summer dens and resting sites, and for cover for prey species. The distribution and abundance of martens is determined to a large extent by the availability of cover and the presence of prey species (Simon 1980).

Throughout the year, especially in the winter, small mammals are an important food source for martens. During the summer their diet is supplemented by birds, insects, fruits, and berries.

The model was developed to evaluate the potential quality of winter habitat for the marten (Suring et al. 1988a). The underlying assumption is that if adequate winter habitat is available, habitat requirements throughout the rest of the year will not be limited. The model incorporated the following factors in the analysis: (1) classes of timber volume in old-growth forests, (2) stand size classes (stand age), (3) beach fringe habitat, (4) riparian habitat, (5) elevation, and (6) old-growth patch size.

The marten model (with patch-size effectiveness taken into consideration) indicates there is habitat capability for an estimated 144 martens in the North Revilla Project Area (Table 3-39). This 10 percent decline from the 1954 habitat capability is due to past harvest activity.

Black Bear

The black bear was selected as an MIS to represent estuarine habitat and because it is an important game species. Black bears occur thoughout the Project Area, and populations are currently stable. As of the 1990/91 black bear harvest season, nonresident hunters have been limited to one black bear, while Alaska residents may harvest two black bear.

Black bears are highly adaptable and can tolerate moderate disturbances, such as habitat alteration, as long as the basic requirements for food and cover are satisfied (Lawrence 1979). As clearcut stands mature, both forage resources and numbers of denning sites may decline.

After emergence from dens in the spring, black bears seek sources of new plant growth for food (Mondafferi 1982). Grass flats of estuaries, low elevation forests near the beach (beach fringe habitats) and avalanche slopes provide the needed high quality forage. Estuaries receiving heavy spring bear use include Klu Bay, Neets Bay, and Traitors Cove. During the summer, black bears feed on forbs, berries, and salmon. In the fall they feed on berries and forbs (Sidle and Suring 1986) in the subalpine areas.

Bear den sites include: (1) cavities in trees and stumps, (2) caves, and (3) excavated and natural depressions under tree roots, stumps, and fallen logs. Black bears search for food in clearcuts that provide access to cover, which is found in mature and old-growth forests. Clearcuts 10 to 15 years old are preferred because of the production of large amounts of berries (Lindzey and Menslow 1977).

The model for black bears incorporated the following factors in the analysis: (1) the average annual value of upland habitats, (2) the average annual value of riparian habitats and potential salmon production, and (3) the average annual value of beach fringe habitats. For more information regarding the model see: Suring et al. 1988b.

The black bear model indicates there is habitat capability for an estimated 182 black bears in the North Revilla Project Area (Table 3-39). This is a 3 percent decline from the pre-1954 habitat capability.

Bald Eagle

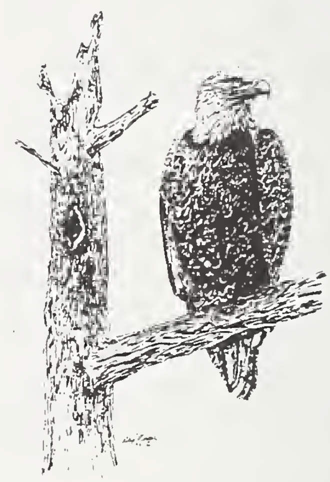
The bald eagle was selected as an MIS because the public has a strong interest in the species and the species has special habitat requirements. Bald eagle habitat is defined as beach fringe habitat. The majority of eagles in Southeast Alaska nest in coniferous forest habitats along the coastline and associated saltwater inlets (Suring et al. 1988c). Eagles prefer to nest in continuous stands of old-growth rather than in narrow leave strips of old-growth trees. Of the 3,850 nests surveyed in Southeast Alaska, 92 percent were within 300 feet of the shoreline (Hodges and Robards 1982).

Bald eagles nest adjacent to the habitat that provide the best opportunities for foraging or searching for food, such as over open water and on tidal flats. Eagles primarily feed on fish, but are also known to feed on waterbirds, marine invertebrates, and drifting carrion. Perching sites near the nest and foraging areas are also important components of bald eagle habitat. The bald eagle and its habitat have been given special protection through the Bald Eagle Protection Act as implemented by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). Among the provisions of the Interagency Agreement are: requirement of a 330-foot vegetation protection buffer around eagle nests, timing restrictions for blasting within 1/2 mile of known nests, and a requirement that formal consultation with the U.S. Fish and Wildlife Service take place when any portion of the agreement cannot be implemented. The U.S. Fish and Wildlife Service has identified 85 nest sites in the North Revilla Project Area. Table 3-41 displays the number of identified eagle nests which occur in each WAA.

Table 3-41
Number of Eagle Nests by WAA

WAA	# Nests
509	14
510	71
Total	85

SOURCE: Matson, 1993. Data derived from GIS data base.



The model evaluated only the nesting habitat of bald eagles because limited information is available on the winter habitats and movements of bald eagles in Southeast Alaska (Suring et al. 1988c). The model considered the following factors in the analysis: (1) old-growth forest, (2) volume class, (3) distance from shore, and (4) elevation of riparian habitat.

The model indicates there is nesting habitat capability for an estimated 137 eagles (Table 3-39). This is a 41 percent decline from the pre-1954 habitat capability. Some evidence exists that food may be the most limiting factor, not nest sites (TLMP Revision 1991a).

River Otter

The river otter was selected as an MIS to represent riparian habitats and because it is an important furbearer.

River otters concentrate along intertidal zones and the adjacent narrow beach fringe. They also travel extensively throughout streamside habitats. The old-growth forests in Southeast Alaska are assumed to provide optimum habitat for river otters (Suring et al. 1988d), with seedling and sapling (i.e., clearcut) and pole timber stands providing limited habitat. Otters avoid clearcuts extending to the beach in Southeast Alaska (Larsen 1983) because of lack of cover and density of shrub growth. High value otter habitat must provide adequate shelter in addition to sufficient food (Melquist and Hornocker 1983). River otters feed on fish (primarily sculpins and rockfish), crabs, and occasional invertebrates other than crabs (Sidle and Suring 1986).

River otters depend on large woody debris (LWD) in streamside, lakeside, and beach habitats. The large extensive root systems, downed tree trunks, and overturned root wads of old-growth trees create undercuts and hollows that maintain den and resting sites, and cover. From May through July, female otters use old-growth habitats near streams for inland (up to 0.5 miles from the coastline) dens. The annual harvest of river otter on the Tongass National Forest has varied from a high in 1979-80 of 652 animals, to a low of 373 animals in the 1986-87 harvest season. Harvest numbers are a function of both otter abundance and trapper effort.

Habitat capability for this species was determined for spring (May through July) because river otters make use of all occupied habitats at this time of year (Suring et al. 1988d). The model incorporated the following factors in the analysis: (1) distance from saltwater, (2) beach, (3) estuary, (4) elevation of riparian habitat, (5) volume class, (6) stream class, and (7) lake size.

The model indicates there is habitat capability for an estimated 66 otters (Table 3-39) in the North Revilla Project Area. This is a 12 percent decline in habitat capability from the pre-1954 habitat capability.

Red Squirrel

Optimum habitat for red squirrels provides opportunities for food sources, food caching sites, and nesting cover (Vahle and Patton 1983). This includes forested stands with two or more species of conifers of cone-bearing age for food, snags for den sites, and downed logs cache sites. These conditions are best provided in old-growth Sitka spruce forests in Southest Alaska. Other forest types provide life requirements of red squirrels, but food resources are not as plentiful as they are in spruce forests. Red squirrels represent a species that can survive fairly well in second-growth timber stands at seed-producing age. The red squirrel model evaluates habitat capability based on elevation and vegetation.

In the North Revilla Project Area, the model indicates there is habitat capability for an estimated 70,793 red squirrels (Table 3-39). This is an 8 percent decline in habitat capability since 1954.

Hairy Woodpecker

The hairy woodpecker was chosen as an MIS representing cavity users because of its preference for stands of old-growth western hemlock and Sitka spruce, and for its association with snags (standing dead trees). Hairy woodpeckers are year-round residents in Southeast Alaska and use snags and partially dead trees for nesting and foraging. These woodpeckers feed on larvae of wood-boring beetles, other insects, and seeds and berries in winter (Sidle and Suring 1986).

The hairy woodpecker is important as a primary cavity excavator because by drilling holes in trees it creates habitat needed for other wildlife species (Kesseler 1979; Noble and Harrington 1977). Forty-two species of mammals and birds in Southeast Alaska nest or den in tree cavities, including woodpeckers, owls, hawks, waterfowl, bats, squirrels, martens, and otters. Several of these species depend exclusively on cavities in the large diameter snags characteristic of old-growth stands for nest and den sites. Most cavity nesting or denning species would be represented by hairy woodpeckers and respond similarly to proposed activities.

Hairy woodpecker habitat is defined as Volume Class 4–7 stands below the subalpine category. Availability of suitable winter habitat for roosting and foraging is considered an important constraint on the habitat suitability of the hairy woodpecker. The model (Suring et al. 1988e) incorporates the following factors in the analysis: (1) old-growth forests; (2) volume class; and (3) old-growth patch size.

The model indicates there is habitat capability in the North Revilla Project Area for an estimated 1,051 hairy woodpeckers (Table 3-39). This is a 28 percent decline from the pre-1954 habitat capability.

Brown Creeper

The brown creeper was chosen as an MIS because it is associated with large, old-age trees and represents the old-growth forest community. Brown creepers and other bark foraging birds also select larger diameter trees as foraging sites during cold, windy weather to lessen their exposure (Grubb 1975, Webber 1986). The diet of brown creepers consists of larvae, pupae, and eggs of insects gleaned from the crevices of bark, spiders, other small invertebrates, and occasionally seeds (Pearson 1923, Reilly 1968). Large diameter trees are preferred because a bird can feed longer on a large tree and capture more prey per visit (Airola and Barrett 1985).

The abundance of large coarse-barked trees and the length of the vertical foraging height appears to affect the territory size (Apfelbaum and Hanley 1977); the area necessary to support the birds increases as the number of large, tall trees decreases. Brown creepers spend most of their time foraging on live parts of trees rather than dead trees (Morrison et al. 1987).

Brown creeper habitat is defined as Volume Class 6 and 7. Slightly more than one tenth of the number of brown creepers observed in stands with 30,000 board feet per acre were observed in stands with 20-30,000 board feet per acre (i.e., Volume Class 5) (Hughes 198-5). Other habitats in Southeast Alaska were not considered to provide suitable habitat for brown creepers.

The model indicates there is habitat capability in the North Revilla Project Area for an estimated 1,338 brown creepers (Table 3-39). This is a 62 percent decline from the pre-1954 habitat capability.

Vancouver Canada Goose

The Vancouver Canada goose was selected as an MIS to represent old-growth and riparian habitats. The Vancouver Canada goose is also a game species.

Banding studies have indicated Vancouver Canada geese are primarily nonmigratory (Ratti and Timm 1979) and are found almost exclusively in Southeast Alaska. These geese use forested habitats for nesting and brood rearing: they place nests in trees, use trees for perches during incubation, and rely primarily on forest understory plant species for food during this part of their life cycle (Doyle et al. 1988). Lebeda and Ratti (1983) suggest that the three most important factors for nesting Vancouver Canada geese are: (1) dense understory vegetation, (2) forest surface water, and (3) an abundant food source.

For analysis of Vancouver Canada goose habitat suitability, the following habitats were selected: estuaries, anadromous streamsides, and lakesides. Muskegs are also important habitats for the geese, but cover such numerous acres of the Project Area that they are not a limiting factor; muskegs therefore were not included in the habitat analysis for this species.

The model indicates there is habitat capability in the North Revilla Project Area for an estimated 243 Canada geese (Table 3-39). This is a 10 percent decline from the pre-1954 habitat capability.

Gray Wolf

The gray wolf was selected as an MIS species because of concerns expressed by the public as to what effects additional timber harvest and higher road densites would have on the wolf population within the North Revilla Project Area.

Gray wolves do not exhibit a preference for specific habitats or habitat characteristics (Paradiso and Nowak 1982). The presence and well being of gray wolves appears to be dependant on the availability of prey rather than land form, climate or vegetation.

A review of the population dynamics of gray wolves demonstrated that rates of increases are primarily determined by the availability of deer and other ungulate prey (Keith 1983). Packard and Mech (1980) concluded that intrinsic social factors and the influence of the food supply are interrelated in determining population levels of gray wolves. It has been demonstrated that predation by gray wolves sustains declines in ungulate populations that have be initiated by other factors (e.g., severe weather, habitat changes) (Mech and Karns 1977, Nelson and Mech 1981, Gasaway et al 1983, Van Ballenberghe and Hanley 1984, Smith et al. 1986).

Prey species available to gray wolves in Southeast Alaska include Sitka black-tailed deer, moose, mountain goat, beaver, and spawning salmon. Of these species, deer beaver and spawning salmon are the primary prey in the North Revilla Project Area.

The habitat capability model developed for wolf primarily runs off the habitat capability model outputs of the deer, moose and mountain goat models. The gray wolf habitat capability model estimates the North Revilla Project Area can support approximately 4 wolves (Table 3-39). This is a 50 percent reduction from the pre-1954 habitat capability.

Effects of the Alternatives

This analysis considers the direct, indirect, and cumulative effects of timber management in the Project Area. Direct effects are projected to 1997, the anticipated end of the current proposed action; to 2004, which includes the reasonably foreseeable future and the end of the KPC long term sale contract; to 2040, to show the cumulative impacts of past and proposed timber harvest; and to 2140, to show the cumulative impacts of harvesting all the tentatively suitable lands through the first rotation and half way through the second.

Direct and Indirect Effects

Comparison of Alternatives: Effects on Wildlife Habitat

Each action alternative includes harvest of wildlife habitat. Project unit design criteria, BMP's (FSH 2509.22, 1991), and/or legislated protective measures (TTRA) and Forest Standards and Guidelines significantly reduce or eliminate potential impacts to beach fringe, estuary fringe, and riparian habitats in each alternative. Alpine/subapine habitat is also affected slightly (less than 120 acres) by road and unit location because of inaccessibility and/or low productivity. Changes throughout the Project Area in these habitats are one percent or less for each alternative (Table 3-44). Impacts to MIS that dependent on these habitats are low. Alternative 1, the no-action alternative, will harvest no acreage, with the effect that existing wildlife habitats will remain at current levels, with changes over time due only to natural succession or future timber harvest.

Table 3-42 displays the percent change in wildlife habitats as a result of timber harvest.

Table 3-42
Proposed Acres for Harvest and Percent Change from 1954 in Wildlife Habitats, by Alternative

	1954 Acres	Existing Acres	Alt. 1 Acres Cut	Alt. 1 % Chg	Alt. 2 Acres Cut	Alt. 2 % Chg	Alt. 3 Acres Cut	Alt. 3 % Chg	Alt. 4 Acres Cut	Alt. 4 % Chg	Alt. 5 Acres Cut	Alt. 5 % Chg	Alt. 6 Acres Cut	Alt. 6 % Chg
Beach Fringe	4,964	4,964	0	0	0	0	0	0	0	0	0	0	0	0
Estuary Fringe	2,147	2,147	0	0	0	0	0	0	0	0	0	0	0	0
Riparian	14,895	14,895	0	0	552	- 4	474	- 3	428	- 3	425	- 3	536	- 4
Old Growth	74,540	56,927	0	0	8,232	-14	5,734	-10	5,920	-10	6,424	-11	6,568	-12
Alpine/Subalp.	16,971	16,971	0	0	120	- 1	60	-<1	60	-<1	80	-<1	60	-<1

SOURCE: Matson 1993. Data derived from GIS data base.

Beach Fringe. None of the alternatives proposes any timber harvest within the 500-foot beach fringe zone.

Estuary Fringe. None of the alternatives proposes any timber harvest within the 1,000-foot estuary fringe zone.

Riparian. For the purpose of this analysis, riparian habitat was identified by using riparian soils, and the Riparian Area Prescriptions as shown in Appendix C. TTRA buffers, or 100-foot minimum buffers around lakes larger than five acres, are not proposed for harvest.

Old-Growth Forest. Old-growth forest comprises 56,927 acres of the 74,540 acres of commercial forest in the Project Area. Within some harvest units are scattered patches of nonforested or low productivity forest types. The biggest difference among the alternatives is the total number of acres scheduled for harvest for each particular alternative. Alternative 2 proposes to harvest 14 percent of the existing old-growth forest. Alternatives 3, 4, 5, and 6 harvest 10 percent, 10 percent, 11 percent, and 12 percent respectively. The effects of old-growth habitat loss on old-growth associated species are reflected in Habitat Capability for MIS later in this section. For a discussion of the amount of timber harvest by volume class, see the Silviculture, Timber and Other Vegetation section of this chapter.

Alpine/Subalpine. All of the action alternatives propose a minor amount of timber harvest (60–120 acres) in the subalpine habitat.

Comparison of Alternatives: Effects on Habitat Capability

The previous section discusses changes to wildlife habitats used by the MIS. This section discusses how those changes in habitats affect the potential habitat capability for each MIS. As mentioned in the Affected Environment earlier in this section, the models that estimate the capability of habitats to support selected species are not necessarily accurate reflections of actual populations in the Project Area. Actual population levels are not known for a given period in time and probably never will be due to weather, hunting/trapping, disease, predation, and other related factors which are difficult or impossible to predict for any given time in the future. However, changes in amount and quality of habitat, as estimated by each MIS model, are considered reasonable predictors of long-term changes in a population trend that are associated with the amount and quality of the habitat only.

Several MIS show a habitat/use relationship with the size of preferred habitats. The wildlife models for this analysis take into account those patch size relationships for Sitka black-tailed deer, marten, and hairy woodpecker. Direct impacts to black bears, otters, and bald eagles have been greatly reduced in all action alternatives through avoidance of timber harvest in beach fringe, estuary fringe, stream corridors, riparian, and alpine/subalpine habitats.

Alternative 1 would have no direct effect on habitat capabilities for any MIS. Tables 3-43 through 3-52 display the changes in habitat capabilities, measured against Alternative 1, that would occur under Alternatives 2 through 6.

Sitka Black-tailed Deer Sitka black-tailed deer are dependent on low elevation, high volume, old-growth stands during severe winters, and are the MIS most affected by proposed timber harvest under the action alternatives. Alternative 2 would decrease habitat capability 6 percent in the Project Area while Alternatives 3, 4, 5,

and 6 would decrease habitat capability 5 percent, 5 percent, 4 percent and 6 percent, respectively (see Table 3-43).

Second-growth canopy closure in timber stands 20 to 30 years after harvest may be delayed by thinning to promote forage production (Hanley et al. 1989). Second-growth forest management has been widely used in Southeast Alaska, but recent research has not documented benefits to Sitka black-tailed deer from thinning and canopy gaps. Potential areas for thinning are listed in Appendix I.

Table 3-43
Changes in Habitat Capability for Deer to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability*	1,700	1,592	1,615	1,617	1,628	1,602
Change in Capability	0	-108	- 85	- 84	- 72	- 99
Percent Change	0	- 6%	- 5%	- 5%	- 4%	- 6%

* Numbers do not incorporate Patch-size Effectiveness calculations.
SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Black Bear Avoidance of beach fringe, estuary fringe, stream corridors, and riparian habitat with timber harvest is reflected in a less than one percent decline in black bear habitat capability for all action alternatives. Alternatives 2, 5 and 6 would harvest habitat capable of supporting an estimated 2 black bears, representing a 1 percent decline in habitat capability, while Alternatives 3 and 4 will harvest habitat capable of supporting an estimated 1 black bear (Table 3-44).

Table 3-44
Changes in Habitat Capability for Black Bear to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	182	180	181	181	180	180
Change in Capability	0	-2	-1	-1	-2	-2
Percent Change	0	-1%	<-1%	<-1%	-1%	-1%

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Marten The marten is an old-growth associated species that uses a wide range of old-growth volume classes, tree species, and landscape positions. Alternative 2 would harvest habitat capable of supporting an estimated 17 martens, for a 12 percent decline in habitat capability. Alternatives 3 and 6 would decrease habitat capability 9 and 10 percent, while Alternatives 4 and 5 would decrease habitat capability 8 percent (see Table 3-45 . Martens are easily trapped and can be overharvested, especially where trapping pressure is heavy (Strickland, et al., 1982) and not effectively controlled. Without an access management plan to keep open accessible road densities

to less than 0.5 miles of road per square mile, there could be an additional 85 percent reduction in population levels due to trapping (Suring et al 1988). Trapping impacts are expected to be minimal due to limited access. Road management objectives have been developed for the Project Area and can be found in Appendix E.

Table 3-45
Changes in Habitat Capability for Marten to Year 1997*

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability**	144	127	131	133	132	130
Change in Capability	0	-17	-13	-11	-12	-14
Percent Change	0	-12%	- 9%	- 8%	- 8%	-10%

* Without road density effects.
** Numbers do not incorporated Patch-size Effectiveness calculations.
SOURCE: Matson 1993.

River Otter The otter is another species that benefited from measures taken during unit design which limited timber harvest in beach fringe, estuary fringe, stream corridors, and riparian habitat. Alternatives 2 through 6 would harvest habitat capable of supporting an estimated 1 otter (Table 3-46).

Table 3-46
Changes in Habitat Capability for River Otter to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	66	65	65	65	65	65
Changes in Capability	0	-1	-1	-1	-1	-1
Percent Change	0	-2%	-2%	-2%	-2%	-2%

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Red Squirrel The red squirrel is most successful in old-growth stands. Changes in habitat capability under the action alternatives range from 10 to 11 percent (Table 3-47).

Table 3-47

Changes in Habitat Capability for Red Squirrel to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	70,793	63,214	63,635	63,750	63,627	63,540
Changes in Capability	0	-7,579	-7,158	-7,043	-7,166	-7,253
Percent Change	0	-11%	-10%	-10%	-10%	-10%

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Hairy Woodpecker The hairy woodpecker is a primary excavator that prefers high volume, old-growth timber, but can also effectively use lower volume stands. Alternative 2 would decrease habitat capability 17 percent in the Project Area; Alternatives 3, 4, 5, and 6 would decrease habitat capability by 13 percent, 11 percent, 12 percent, and 14 percent respectively (Table 3-48). Hairy woodpeckers may also benefit from snag retention in clearcuts as a mitigation of timber harvest (see Snag Abundance Analysis and Chapter Two Mitigation).

Table 3-48

Changes in Habitat Capability for Hairy Woodpecker to Year 1997, by Alternative

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability*	1,051	874	919	933	921	909
Change in Capability	0	-177	-132	-118	-130	-142
Percent Change	0	-17%	-13%	-11%	-12%	-14%

* Numbers do not incorporate Patch-size Effectiveness calculations.
SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Snag Abundance Analysis

TLMP Draft Revision (1991a) standards and guidelines call for maintaining a minimum of 275 snags per 100 acres of forested habitat for cavity nesting wildlife species. An analysis was completed for all VCU's within the Project Area to determine if prior harvest has reduced the number of snags below Forest standards and guidelines.

This analysis was accomplished by using snag densities for the various timber types existing within the Project Area, as determined by Noble and Harrington (1978). In evaluations, the size and species of snags were accounted for. Areas that had been previously harvested were assumed to have no snags. The maximum number of snags per acre assumed to be useable was eight per acre; it was assumed that more than eight snags per acre were in excess of nesting and courtship needs of the hairy woodpecker, which was the MIS chosen to represent cavity dwellers and users of snags for the North Revilla Project Area. The analysis indicates that there is an

adequate number of snags existing in all VCU's. However, some VCU's were identified as needing further analysis to confirm adequate distribution of snags, such as VCU's 735, 736, 737, 738, and 740.

Based on map and photo review, the following units will have snag patches within the unit, to maintain a good distribution of available snags:

3021	7004	8017
3037	7009	8022
5038	7038	8041
6008	7086	9082
6011	8003	9091
6024	8009	
6049	8010	

Brown Creeper The brown creeper prefers large old-growth trees. All action alternatives would remove habitat capable of supporting an estimated 133 (Alt. 4) to 207 (Alt. 2) brown creepers (Table 3-49). Alternative 2 would decrease habitat capability by 15 percent, while Alternatives 3, 4, 5, and 6 would be 11, 10, 11, and 12 percent repectively.

Table 3-49
Changes in Habitat Capability for Brown Creeper to Year 1997

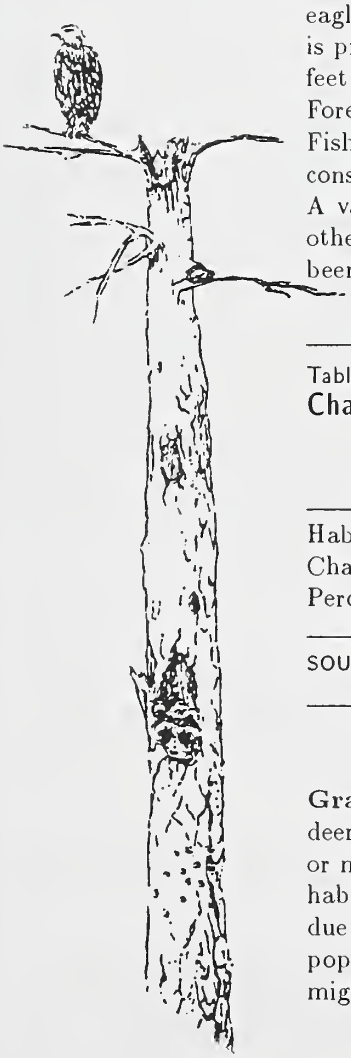
	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	1,338	1,131	1,192	1,205	1,197	1,178
Change in Capability	0	-207	-146	-133	-141	-160
Percent Change	0	-15%	-11%	-10%	-11%	-12%

SOURCE: Matson, 1993. Data derived from GIS data base and interagency habitat capability model.

Vancouver Canada Goose The Vancouver Canada goose nests in forested areas in proximity to open water and preferred food plants. All action alternatives would harvest habitat capable of supporting an estimate of between 16 (Alt. 4) and 24 (Alt. 2) geese in the Project Area. All action alternatives would decrease habitat capability 7 to 10 percent in the Project Area (Table 3-50).

Table 3-50
Changes in Habitat Capability for Vancouver Canada Goose to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	243	219	227	225	223	222
Change in Capability	0	−24	−17	−16	−19	−19
Percent Change	0	-10%	- 7%	- 7%	- 8%	- 8%



Bald Eagle Scheduling development activities away from beach fringe, estuary fringe, lake buffers, and Class I and II streams will effectively reduce impacts to bald eagle nesting habitat. A one percent or less decrease in nesting habitat capability is predicted for any alternatives (Table 3-51). Management activities within 330 feet of an eagle nest site are restricted by an Interagency Agreement between the Forest Service and the U.S. Fish and Wildlife Service (USDA Forest Service and USDI Fish and Wildlife Service 1990). A variance to the agreement has been requested to construct a road within 330 feet of Eagle Nest #42 on the east side of Hassler Island. A variance was requested because the topography in the area did not allow for any other alternative road locations that avoided the eagle nest area. The variance has been approved by the U.S. Fish and Wildlife Service (Jacobson 1993).

Table 3-51
Changes in Nesting Habitat Capability for Bald Eagle to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	137	135	136	136	136	136
Change in Capability	0	- 2	- 1	- 1	- 1	- 1
Percent Change	0	1%	<1%	<1%	<1%	<1%

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Gray Wolf. The gray wolf habitat capability model runs off the Sitka black-tailed deer habitat capability model, since there are not any significant numbers of moose or mountain goats in the Project Area. All action alternatives maintain the current habitat capability. The habitat capability does not include the effects of road density, due to the fact the all the road systems are isolated, and not connected to any large population centers. The Cumulative Effects section includes a discussion of effects that might be anticipated if a road system is connected to the Ketchikan road system.

Table 3-52
Changes in Nesting Habitat Capability for Gray Wolf to Year 1997

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Habitat Capability	4	4	4	4	4	4
Change in Capability	0	0	0	0	0	0
Percent Change	0	0	0	0	0	0

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability model.

Comparison of Alternatives: Summary

Table 3-53 summarizes the habitat capability for each MIS in 1954, 1993, & 1997. It also includes the percent change from 1954 to 1997.

Table 3-53
Summary of Habitat Capability in the Year 1997 and Percent Change from 1954

			Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
Species	1954	1993	1997	% Chg	1997	% Chg	1997	% Chg	1997	% Chg	1997	% Chg	1997	% Chg
Deer*	3,206	1,700	1,700	-47	1,592	-50	1,615	-50	1,617	-50	1,628	-49	1,602	-50
Black Bear	187	182	182	- 3	180	- 4	181	- 3	181	- 3	180	- 4	180	- 4
Marten*	160	144	144	-10	127	-21	131	-18	133	-17	132	-17	130	-19
Otter	75	66	66	-12	65	-13	65	-13	65	-13	65	-13	65	-13
Red Squirrel	76,774	70,793	70,793	- 8	63,214	-17	63,635	-17	63,750	-17	63,627	-17	63,543	-17
Hairy Woodpecker*	1,470	682	1,051	-28	874	-41	919	-37	933	-37	921	-37	909	-38
Brown Creeper	3,526	1,338	1,338	-62	1,131	-68	1,192	-66	1,205	-66	1,197	-66	1,178	-67
Vancouver Canada Goose	269	243	243	-10	219	-19	227	-16	225	-16	223	-17	222	-17
Bald Eagle	233	137	137	-41	135	-42	136	-42	136	-42	136	-42	136	-42
Gray Wolf	8	4	4	-50	4	-50	4	-50	4	-50	4	-50	4	-50

* Numbers do not incorporate Patch-size Effectiveness calculations (See the Old-Growth/Biodiversity section).
SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability models.

Cumulative Effects: Reasonably Foreseeable

This portion of the analysis (reasonably foreseeable) will focus on effects to the year 2004, which is halfway through the first rotation and the end of the Long-Term Contract with KPC. TLMP Revision (1991a) considers cumulative effects for 150 years and is incorporated here by reference.

Habitat capability was not calculated for State and private lands. This will represent a maximum potential impact, because even if these lands are harvested, they would be providing at least some minimal habitat capability.

Alternative 2 is used to display the reasonably foreseeable future actions, because this is the maximum harvest alternative, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

Table 3-54 shows the direct effects on habitat capability for MIS of the reasonably foreseeable actions from 1954 through 2004, using Alternative 2 as being equal to the total effects of the reasonably foreseeable actions of all the other alternatives.

Table 3-54

Reasonably Foreseeable Direct Changes in Habitat Capability for MIS, 1954-2004.

Species	Habitat Capability 1954	Habitat Capability 1993	Habitat * Capability 2004	Percent * Reduction From 1954
Sitka black-tailed deer **	3,205	1,700	1,592	50
Black bear***	187	182	180	4
Marten ** ***	160	144	127	21
River Otter	75	66	65	13
Red Squirrel **	76,774	70,793	63,214	18
Hairy Woodpecker **	1,324	1,051	874	34
Brown Creeper **	3,526	1,338	1,131	68
Vancouver Canada Goose	269	243	219	19
Bald Eagle	233	137	135	42
Gray Wolf	8	4	4	50

* Based on Alt.2, because Alt.2 volume of 260 MMBF is the maximum harvest amount.

** Numbers do not incorporate Patch-size Effectiveness calculations (See Old-Growth/Biodiversity Section).

***Does not consider effects of road densities.

SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability models.

Total Cumulative Direct and Indirect effects of Habitat Capability for MIS of Proposed Alternatives in 2040

Decreases in habitat capabilities projected to the end of the Long-Term Contract in 2004 are displayed in Table 3-54. Effects projected from 1996 to 2004 were based on the reduction in habitat capability anticipated for Alternative 2.

Alternative 2 is used to display the reasonably foreseeable future actions, because this is the maximum harvest alternative, and volume not harvested in other action alternatives could be harvested as part of another project by the year 2004.

The total cumulative direct and indirect effects are displayed in Table 3-55; this takes into account the effects of canopy closure on units harvested by all alternatives and all other stands that are currently in the clearcut stage and converting them to the second-growth stage.

Road Density Effects Analysis

The cumulative analysis also displays the effect a road connection between the Project Area and the Ketchikan road system would have on wildlife species, such as gray wolf, black bear and marten. For this part of the analysis it is assumed that the following areas would be accessed: Klam/Klu drainage, Orchard Lake, Shrimp Bay, Neets Lake/Bluff Lake, Fire Cove, and the Traitors Cove Salt Chuck areas. It is also assumed that the following areas will not be accessible: Hassler Island and road systems on the ends of peninsulas; it is also assumed that a road connection is not made between Margaret Lake Camp and Traitors Cove Salt Chuck.

The Project Area includes 171 square miles of land, and the area that is assumed to be accessible in the future amounts to 89 square miles. Within the area assumed to be accessible, there are 28 miles of existing roads and 40 miles of proposed roads, for a total of 68 miles of road.

Gray Wolf. Concern has been expressed that high road densities and liberal hunting regulations can result in over-harvest of the wolf population. TLMP Revision Standards and Guidelines recommend a mitigation measure: consider an open-road density of one mile per square mile of road, or in WAA's that adjoin Wilderness or roadless areas of greater than 247,000 acres (which this Project Area does), consider allowing open-road densities of up to 1.2 miles of Forest development roads per square mile of roaded area.

If it is assumed that all existing and proposed roads in the accessible portion of the Project Area are open, the open-road density in the Project Area would be 0.764 miles of road per square mile (68 miles of road divided by 89 square miles), well under the recommended road density of 1.2 miles of open road per square mile.

Black Bear. Although black bears can adapt to changes in their environment induced by humans, increased access by humans often leads to increased human-related mortality (legal harvest, poaching, and defense of life and property). The black bear habitat capability model has factors that attempt to take this increased mortality into consideration.

For habitat that is linked to a transportation system, the habitat capability of the areas within two miles is reduced by 20 percent. For the analysis of the effect of road density, it is assumed that all areas of the accessible portion of the Project Area are

within two miles of a open road, and that the accessible portion is 50 percent of the total Project Area. So the black bear habitat capability would be reduced by 10 percent (20 percent times 0.5) due to a road connection to the Ketchikan road system. Table 3-55 displays the effect of connecting some of the Project Area road system to the Ketchikan road system.

Marten. There is also concern that marten densities will decrease (due to their susceptibility to overtrapping) as road densities exceed 0.2 miles of road per square mile, and marten densities will be reduced 90 percent as road densities approach 0.6 miles of road per square mile (Suring et al. 1992).

Again, assuming that all of the existing and proposed roads in the accessible portion of the Project Area are open, the open-road density for the Project Area would be 0.398 miles of road per square mile (68 divided by 171). Comparing the the open-road density to the Road Density Graph in the Marten Habitat Capability Model (Suring et al. 1992), the suitability index for marten based on road density is 0.6, so 0.6 was multiplied by the marten model outputs to make adjustments for road densities (see Table 3-55).

Table 3-55
Total Cumulative Direct and Indirect Effects of Habitat Capability for MIS for the Proposed Alternatives of This EIS by 2040 (assuming no further timber harvest)

Species	Habitat Capability 1954	Habitat Capability 1993	Habitat Capability 2040					
			Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Sitka black-tailed deer*	3,205	1,700	1,700	1,563	1,568	1,606	1,608	1,573
Black bear **	168	164	164	151	155	155	154	154
Marten* **	96	87	87	76	78	79	78	77
River Otter	75	66	66	65	65	65	65	65
Red Squirrel	76,774	70,793	70,793	63,214	63,635	63,750	63,627	63,543
Hairy Woodpecker*	1,470	1,051	1,051	874	919	933	921	909
Brown Creeper	3,526	1,338	1,338	1,131	1,192	1,205	1,197	1,178
Vancouver Canada Goose	269	243	243	219	227	225	223	222
Bald Eagle	233	137	137	135	136	136	136	136
Gray Wolf	8	4	4	4	4	4	4	4

* Numbers do not incorporate Patch-size Effectiveness calculations (See Old-Growth/Biodiversity Section).
** Does consider effects of road densities.
SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability models.

Table 3-56 displays the impacts of harvesting the scheduled acres of the suitable-available forest lands in the 150-year planning period, and assumes all harvested stands are in the closed canopy, second-growth condition.

Table 3-56
Total Cumulative Changes Caused by This and Future Timber Sales, in Habitat Capability for MIS to the Year 2140

Species	Habitat Capability 1954	Habitat Capability 1993	Habitat Capability 2004*	Percent Reduction From 1954	Habitat Capability 2140**	Percent Reduction From 1954
Sitka black-tailed deer**	* 3,206	1,700	1,592	50	1,415	44
Black Bear	187	182	180	4	165	12
Marten***	160	144	127	21	122	24
River Otter	75	66	65	13	65	13
Red Squirrel	76,774	70,793	63,214	18	62,522	19
Hairy Woodpecker***	1,470	1,051	874	34	575	39
Brown Creeper	3,526	1,338	1,131	68	465	87
Vancouver Canada Goose	269	243	219	19	173	36
Bald Eagle	233	137	135	42	133	43
Gray Wolf	8	4	4	50	3	62

*Based on Alt.2, because Alt. 2 volume of 260 MMBF is the maximum harvest amount.
**Assumes harvest of all suitable-available forest lands identified by the TLMP Draft Revision, Alt. P (1991a) within the Project Area.
***Numbers do not incorporate Patch-size Effectiveness calculations.
SOURCE: Matson 1993. Data derived from GIS data base and interagency habitat capability models.

OLD GROWTH AND BIODIVERSITY

Key Terms

Biodiversity - the variety of life and its processes
Canopy - the middle and uppermost layers of foliage in the forest
Corridor - a patch or strip of habitat linking or providing connectivity between larger patches
Edge - boundary between two distinct ecosystems, such as between forest and muskeg
Forage - to search for food
Fragmentation - reducing the size and connectivity of habitat patches; the degree and impacts of fragmentation depend on scale (in space and time) and the life requirements of the affected species
Patch - an assemblage of similar vegetation, such as old-growth forest
Planning Area - for the purpose of analyzing viable populations, the planning area is the ecological province, i.e., Revilla Island/Cleveland Peninsula
Snag - standing dead tree
Viable Population- a population with the estimated numbers and distribution of reproductive individuals to maintain the population over time

Affected Environment

Old-Growth Forest

Most of the commercial forest land in the Tongass National Forest that has not been previously harvested has been undisturbed for centuries and is considered old growth. The definition of old-growth forest varies by habitat and includes such factors as age and size of trees, spacing, snags, canopy layers and structure, and the amount of down (on-the-ground) material (USDA Forest Service 1991a).

Old-growth stands have an uneven appearance because they contain trees of many ages, sizes, and condition, and contain numerous dead tops and snags. Based on past forest inventories, old-growth stands are assumed to have reached an equilibrium where timber growth equals mortality (USDA Forest Service 1991a). Tree establishment largely depends on large woody debris (logs and stumps) (Harmon 1986, Harmon and Franklin 1989) and gap formation (Alaback 1988). Woody debris provides microsites for trees to grow on. Gaps created by windthrow or other disturbances allow light to penetrate to the forest floor. This process of tree death and replacement is continual; in any one year, a significant portion of the trees in individual stands are likely to blow down (Harris 1989). Thus the forest is a mosaic of older and younger trees, dynamically changing yet remaining remarkably stable as a forested ecosystem (Bormann and Likens 1979, Alaback 1988, Schoen et al. 1988, Franklin 1990).

Old-growth forest is an important source of highly valuable forest products. Sitka spruce and western hemlock are eminently suitable for the production of dissolving pulp, used in the manufacture of rayon, acetates, and other synthetic fibers. The better grade trees of these species, along with the cedars, provide some of the finest quality commercial timber for lumber.

Old-growth forest is also important wildlife habitat for old-growth associated species such as Sitka black-tailed deer, martens, black bear, Vancouver Canada geese, and cavity or snag dependent species such as flying squirrels, woodpeckers, and owls. Many species have evolved to use the structural attributes of old-growth forests. The combination of a dense canopy with scattered small openings (typically 20–40 feet across) allows forage growth under openings, while the large limbs within the canopy intercept enough snowfall to provide winter food and thermal cover for deer and other species. The large, dense stems also provide some measure of thermal insulation in the winter, as well as during cold rains in the spring and summer. Large dead or defective trees become nesting sites for martens, owls, eagles, wrens, and chickadees, as well as feeding sites for woodpeckers, sapsuckers, brown creepers, and others.

Old-growth stands contain trees of many ages, sizes, and condition, as well as dead and dying trees and downed woody material.

The value of old-growth forest for wildlife habitat is also thought to transcend individual stands. Large, contiguous, unfragmented blocks of old-growth forest are important to forest interior species, such as the northern goshawk and marbled murrelet. The large old-growth blocks provide expansive hunting territories and protection from predators, and promote genetic mixing among populations that would be less likely to breed if they were spatially separated by forest fragmentation. Deer use these large old-growth blocks for migration routes between winter and summer ranges.

Old-growth forests are an important but decreasing component of the temperate rain forest ecosystem. They differ in ecological function in many ways from younger,

even-aged forests. Old-growth stands typically exhibit a wider variety of reproductive niches for species whose existence is thought to be old-growth dependent—including certain animals, understory plants, and microorganisms which appear to be most successful when permitted to develop under at least a partially intact mature forest canopy.

Old-growth forests also have become important to many people for aesthetic and cultural purposes. Ancient large trees characteristic of some old-growth stands have become symbols of a pristine landscape.

NORTH REVILLA Old-Growth Blocks

Within and immediately adjacent to the Project Area are large, unroaded blocks of old-growth forest (Table 3-57 and Figure 3-5) as identified in the roadless inventory in the TLMP Draft Revision (1991a). The Revilla block (#524) is south of the North Revilla Project Area. This block contains approximately 131,856 acres. Just north of the Revilla block is the 158,831 acre North Revilla block (#526) and includes important wildlife areas such as the Naha LUD II area, Orchard Lake and Creek, Upper Carroll, and areas in Traitors Cove. Both the Revilla and the North Revilla blocks are adjacent to the 2.1-million-acre Misty Fiords National Monument. The Neets block (#527) is 6,315 acres. This roadless area is surrounded by clearcuts and is located out on a pennisula between Neets Bay and Gedney Pass.

Figure 3-5 shows these and other large blocks of old-growth forest, while the Existing Condition Map in the separate map packet shows all remaining unharvested, old-growth, commercial forest within the Project Area.

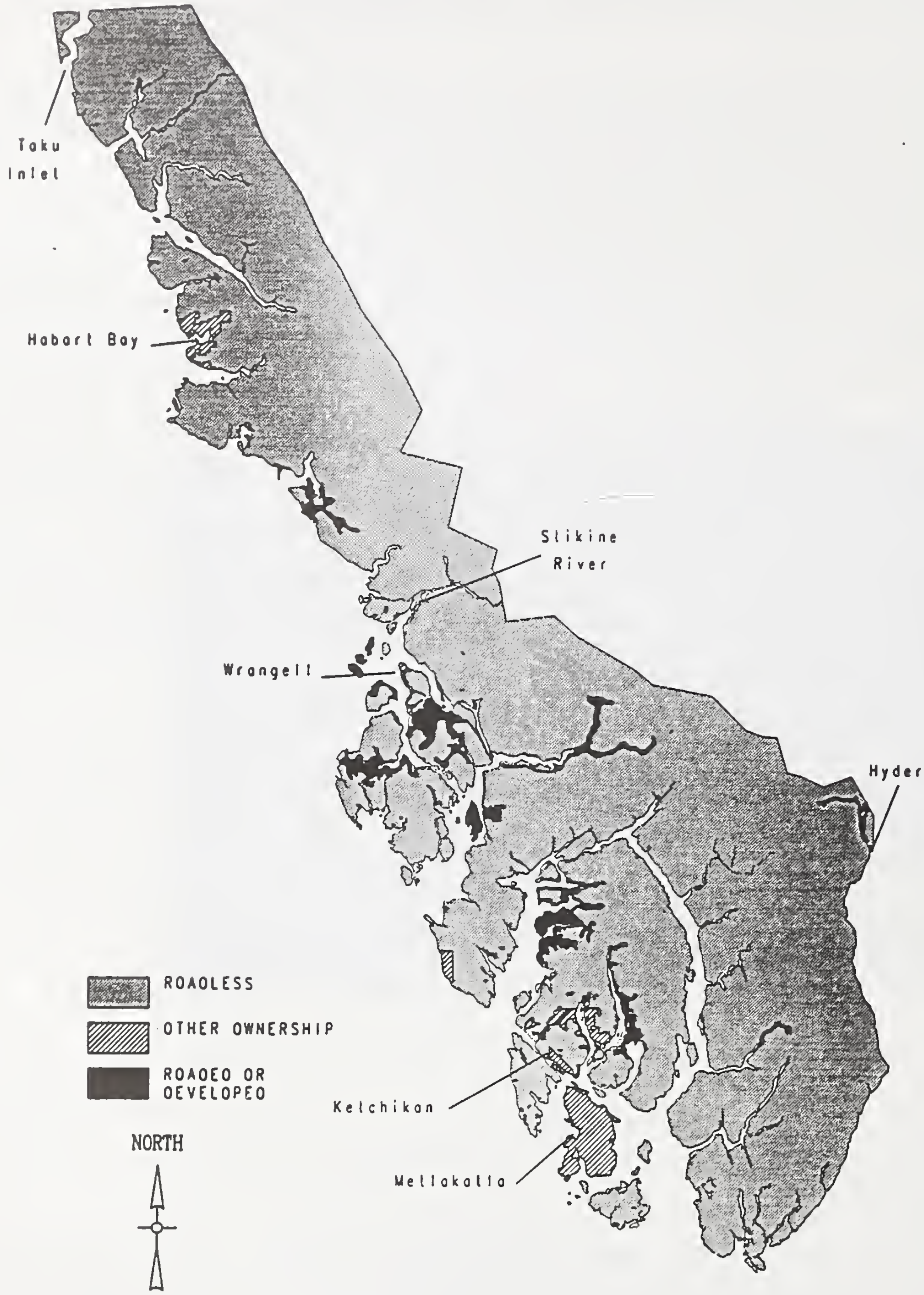
Table 3-57
Roadless Areas and Acreage Within and Adjacent to the N. REV. Project Area

*Roadless Area #	Roadless Area Name	Roadless Area Acreage
524	Revilla	131,856
526	North Revilla	158,831
527	Neets	6,315
	Misty Fiords NM	2,136,000
TOTAL		2,433,002

* These roadless areas are Forest Plan, not Rare II Roadless Areas (See Appendix E TLMP Revision 1991a). SOURCE: Matson 1993

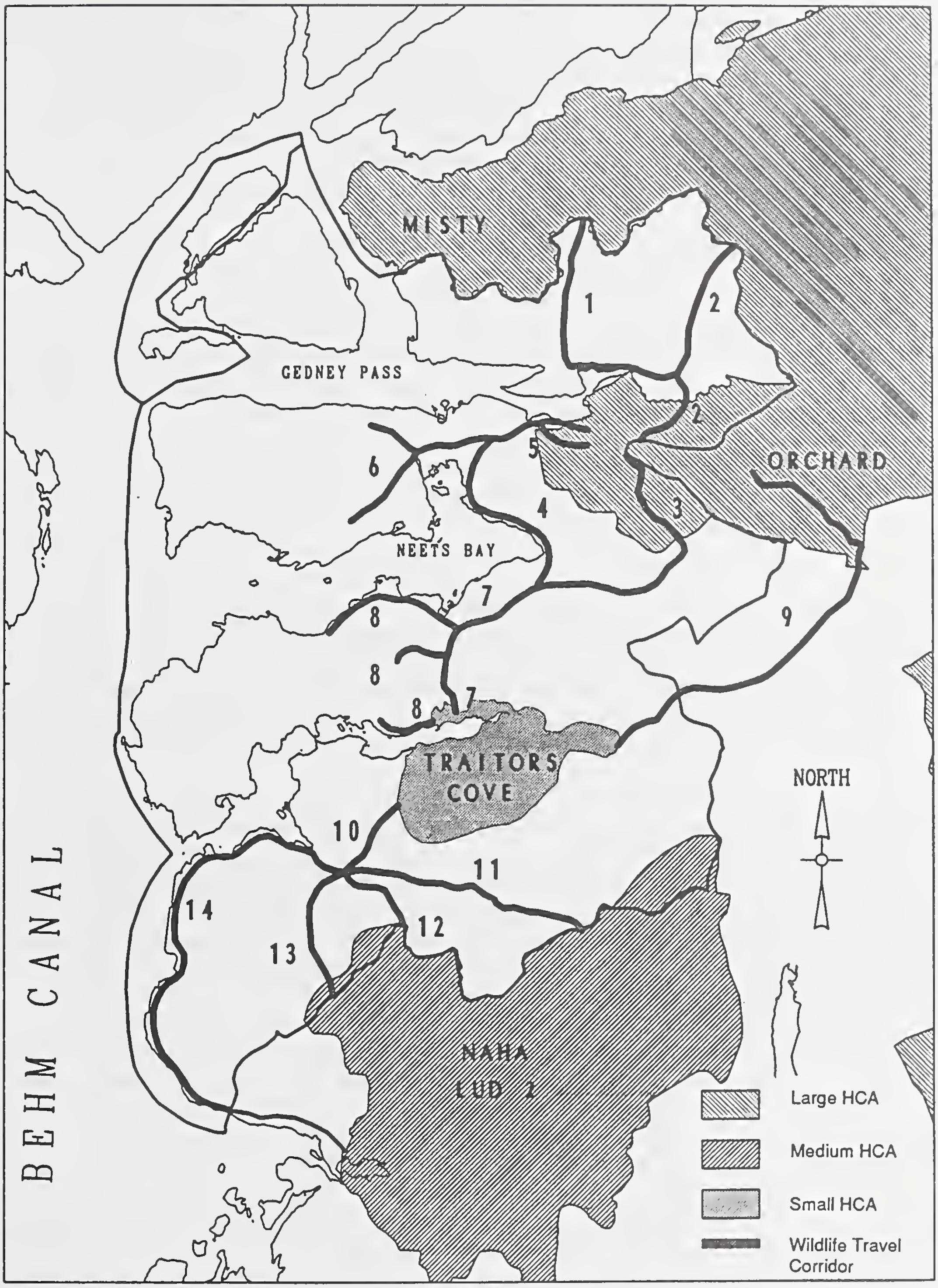
It is recognized that maintaining appropriate habitat corridors or connections between blocks of old-growth forest habitat is important to minimize isolation and gradual decline of wildlife species associated with the old-growth blocks (Harris 1984, 1985; Hunter 1990). Some of the corridors between these blocks have been affected by previous timber harvest activites. While Figure 3-5 displays the areas that are not roaded or developed, Figure 3-6 displays large blocks dominated by old-growth forest and areas that are important for maintaining connectivity between the large blocks.

Figure 3-5
Roadless Areas from Hyder/Misty Fiords NM North to Juneau/Skagway.



Large areas remain in a pristine condition around the Project Area.

Figure 3-6
Important Old-Growth Blocks and Corridors



Large blocks of old-growth forest, and other areas that are important for maintaining connectivity between the large blocks.

Other areas—including stands deemed inoperable for timber harvest because of unstable soils, steep slopes, economic isolation, or other factors—could also be interspersed and provide additional opportunities to connect old-growth blocks, although the TLMP Draft Revision Alt. P has scheduled almost all these lands for harvest. While there has been historic timber harvest within the beach, estuary, and streamcourse buffers, these old harvest sites will mature in time and could provide travel corridors for some wildlife species for genetic interchange.

For additional discussion of old growth and connectivity, see Fragmentation and Connectivity, later in this section.

Biological Diversity and Viable Populations

Biodiversity

The National Forest Management Act (NMFA) defines diversity as the distribution and abundance of different plant and animal communities and species. Biological diversity, or biodiversity, refers not only to the variety of organisms in an area; it also includes their genetic composition, the complex pathways that link organisms to one another and to to the environment, and the processes that sustain the whole system. Biodiversity plays a key role in how well an ecosystem functions. It can be evaluated at different scales, ranging from genetic diversity to landscape diversity.

Genetic diversity is the smallest scale, and refers to the variation in the genes of individual plants, animals, and microorganisms. There is concern when individuals of a species do not reproduce very well (such as Pacific yew) or do not show much variation among individuals. *Species diversity* refers to the variety of living organisms—ranging from beetles to bears, from mosses to massive trees. This scale not only includes the number of different species in an area, but also their abundance and distribution. Loss of genetic diversity and/or severe reductions in the size of populations can subject plant and animal species to increased risk of local extinction (extirpation).

This risk of genetic and species loss is higher if the structure, composition, or function of vital habitats are compromised. An example of such a compromise might be fragmentation of large blocks of suitable habitat into smaller isolated blocks that separate small populations of wildlife species from each other. In managing forest ecosystems, therefore, biodiversity management is often evaluated at larger scales. It is thought that conservation of functioning ecosystems will serve to conserve the suite of species associated with them.

One of these larger scales of diversity— *"within-ecosystem"*— focuses on plant associations and habitat types and the diversity of plants and animals within those communities. This diversity scale usually measures the number of species present (richness) or the structural complexity of a given habitat type. For example, the number of breeding birds in Southeast Alaska has been shown to decline from 13 species in old-growth, spruce-hemlock forests to just 3 species immediately following logging (seedling/sapling stage) as vegetation structure and species composition become greatly simplified (Sidle 1985). As clearcuts (seedling/sapling stage) procede to mid-successional stages (sapling/shrub and pole), species richness temporarily increases to 10 to 14 species, but declines again to seven species in older seral stages (young sawtimber) due to the loss of understory vegetation associated with canopy closure. Retention of snags, live trees, and down woody debris can be used to enhance

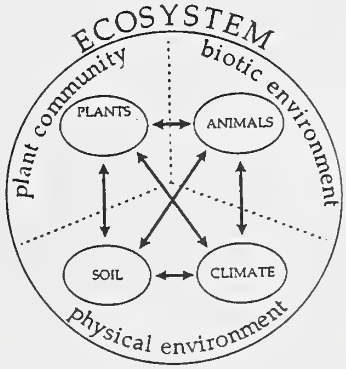
within-ecosystem diversity by maintaining a portion of old-growth structure within regenerating stands (Sidle 1985, DellaSala 1993).

The next scale is *"between-ecosystem"* diversity, which describes the variation from one community to another in a particular area along environmental gradients. Southeast Alaska has a high between-ecosystem diversity, because natural forested patches are relatively small (compared to Oregon and Washington, for example) and are often interspersed in a matrix of muskegs. Large-scale logging can affect this diversity, because it increases the fragmentation of old-growth patches, and is followed by a subsequent uniform age class of second growth that is quite different both from the adjacent old growth and from the muskeg matrix.

The largest scale considered is the diversity of *ecosystems across a landscape*, such as a province or biogeographic region. At this scale, differences in geology—for example the karst region on northern Prince of Wales—and climate come into play. Large areas of several million acres are evaluated and subdivided into ecological provinces and subprovinces (as in the TLMP Draft Revision, 1991a). An area is expected to support high levels of landscape diversity if viable populations of wildlife and habitat types are well distributed across the region. Evaluation of this scale of diversity is important for a number of reasons. Silviculturally, for example, a plant association on limestone-derived soils may respond differently following logging than the same plant association on glacial soils. The frequency of certain forest structural patterns (size and distribution of trees) may also differ on different soils, with profound implications for wildlife habitat.

Diversity must be evaluated at all these different levels, because ignoring scale can lead to adverse effects on ecosystem function. For example, for years it was thought that maximizing forest fragmentation (the "staggered setting" approach) would benefit wildlife, because it maximized forest edges (boundaries between ecosystems). More recent research has found, however, that maximizing edge can ruin forest interior conditions critical for certain species (Forman and Godron 1986, Hunter 1990).

Ecosystem alteration—including habitat destruction, simplification, and fragmentation—is the most pervasive cause of biodiversity loss. Therefore, minimizing habitat alterations and promoting natural patterns help maintain biodiversity. To maintain biodiversity, large natural areas, corridors, and migration routes should be protected; removal of natural barriers should be avoided; areas that have already been developed should be utilized in place of altering undisturbed areas and restoring areas that have been altered. In natural resource management, it is sometimes necessary to focus on what is more limiting (e.g., large old-growth patches) or rare (e.g., possibly some plant or animal species), and to seek to maintain these aspects of the ecosystem, rather than to focus strictly on maximizing the number of species.



The amount of contiguous habitat, and the extent to which similar habitats connect by corridors, are considered key concepts in managing for biological diversity (Harris 1984, 1985; Hunter 1990). Because of the importance of unfragmented old-growth forest patches and the role of these areas in maintaining viable wildlife populations, old-growth habitat and an analysis of patch-size effectiveness will be used in this EIS as tools to evaluate impacts on biodiversity.

For detailed discussion of old-growth blocks and connecting corridors in the North Revilla Project Area, see North Revilla Old-Growth Blocks, earlier in this section, and Fragmentation and Connectivity, later in this section.

A more detailed discussion of Tongass National Forest direction for managing biological diversity can be found in the TLMP Draft Revision, 1991a, Vol. 149, pp. 3-9–3-45.

Viable Populations

Fish and wildlife habitat must be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area. For planning purposes, a viable population is one that has the estimated numbers and distribution of reproductive individuals needed to ensure its continued existence, and is well distributed in the planning area (NFMA 1976). In order to maximize the probability that viable populations will be maintained over time, habitat must be provided to support at least a minimum number of reproductive individuals, and that habitat must be well distributed so that those individuals can interact with others in the forest planning area.

The task of maintaining habitats to support biodiversity has encompassed several methodologies, and alternatives continue to evolve. Prior to the TLMP Draft Revision, the Ketchikan Area established old-growth habitat areas (retention and extended rotation) that were to be retained partially to maintain biodiversity. The first TLMP Draft Revision (1990) required protection of 24 percent of the CFL of each Wildlife Analysis Area, mostly in blocks of 1,000–10,000 acres. The TLMP Supplement to the Draft EIS (1991a) refocused its biodiversity and population viability management strategies at the ecological province level, and took a broader regional view. The Interagency Viable Population Committee of biologists made other recommendations, discussed below.

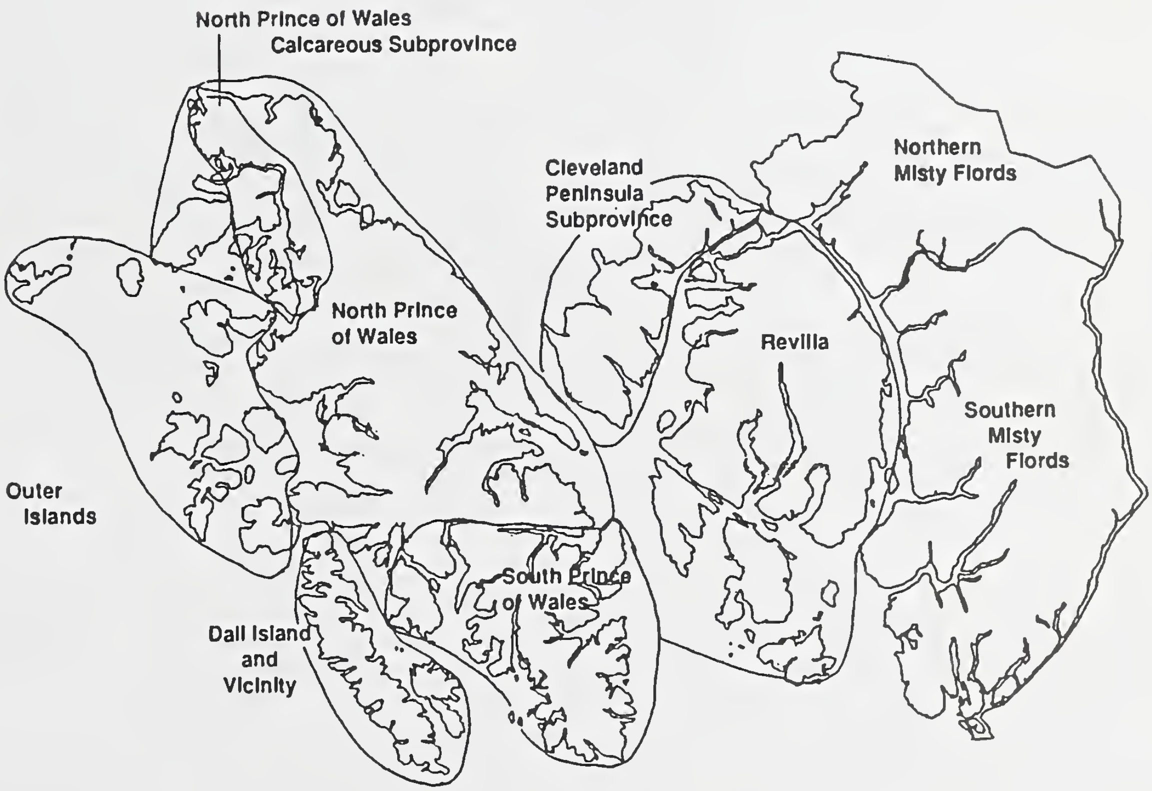
The TLMP Draft Revision provides for regional management and maintenance of population viability at the planning area level. "Planning Area" for defining viable populations is the ecological province level (TLMP Draft Revision 1991a). Under TLMP, individual project areas are not expected to independently maintain viable populations, but only to contribute to and not cause a decline of overall viable populations for the province. However, their contribution to well-distributed populations through the maintenance of connectivity is critical. Standards and guidelines outline prescriptions for maintaining biodiversity at the project area level (TLMP Draft Revision 1991a).

The North Revilla Project Area lies within the Revilla Island/Cleveland Peninsula Ecological Province (#15), as defined by TLMP Draft Revision (1991a). This Province is comprised of 1,169,559 acres, of which 349,879 acres are designated for preservation in a natural setting under the terms of Alternative P for the TLMP Draft Revision (1991a). These 349,879 acres are composed largely of LUD I and II areas, as

well as buffers for beach fringe, estuaries, streams, riparian management areas, and eagle nests.

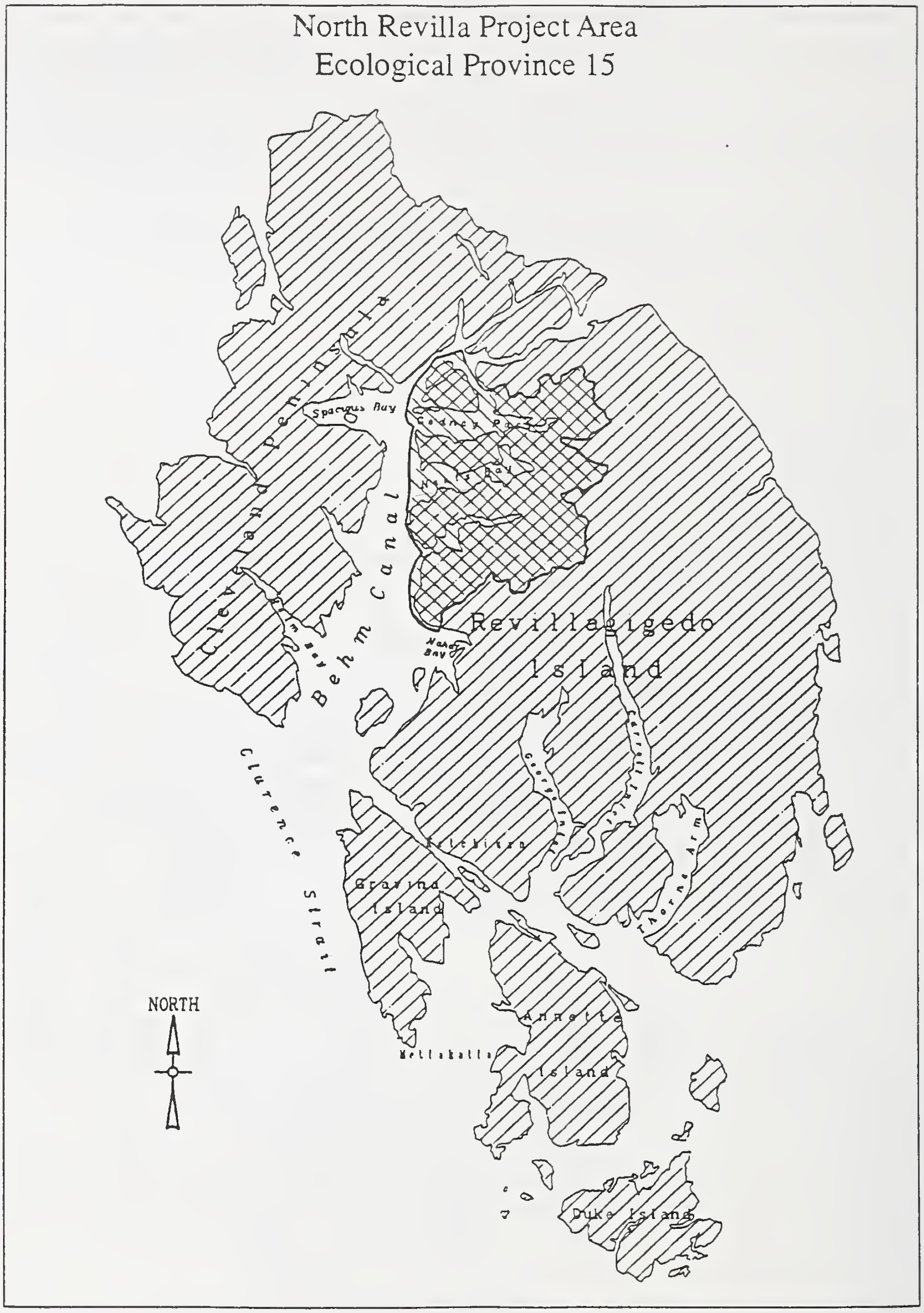
The Revilla Island portion of the ecological province is undeveloped on the east side, and is part of the Misty Fiords National Monument. The Cleveland Peninsula portion of the North Revilla/Cleveland Peninsula Ecological Province is part of the mainland in the Southeast Alaska panhandle. The entire mainland from Hyder/Misty Fiords National Monument north to Juneau/ Skagway area, is in a natural (unaltered by human activities) state, except for some small isolated developments (see Figure 3-5).

Figure 3-7 illustrates the setting of the Project Area within the North Revilla/Cleveland Peninsula Ecological Province (No. 15).



Ecological Provinces of the Ketchikan Area, Tongass National Forest

Figure 3-7
North Revilla/Cleveland Peninsula Ecological Province, No. 15



This province is comprised of 1,269,559 acres, of which 349, 879 acres are designated for preservation in a natural setting in Alternative P of the TLMP Draft Revision (1991a).

VPOP Committee

In an effort to further refine the methodology by which viable populations are maintained, an interagency committee of wildlife biologists appointed by the Forest Service was assembled (Viable Population [VPOP] Committee) to assess whether some species associated with old-growth forests required special standards and guidelines to ensure that their populations remain viable and well distributed across their current ranges on the Tongass National Forest. The VPOP Committee's recommendations were reviewed by the management-level Steering Committee on Viable Populations (Capp et al., October 1991). The VPOP Committee focused on viability risk assessments that could be applied to the evaluation of planning alternatives Forest-wide. The VPOP Committee recommended habitat conservation areas (HCA's) of three sizes: large, medium, and small (Suring et al. 1993). The three different HCA's could be applied to individual planning areas or to multiple planning areas provided sufficient connecting corridors are present to permit dispersal of wildlife across HCA's. The committee formulated criteria for establishing HCA's.

For a large HCA, a tract should include at least 20,000 acres of old growth with over 8 MBF per acre, including at least 10,000 acres with over 20 MBF per acre within a tract of at least 40,000 acres. Large HCA's should be no more than 20 miles apart, edge to edge, to ensure effective dispersal between them. HCA's with these characteristics are believed to be necessary to ensure that viable populations of wide-ranging species such as marten are well distributed within an analysis area.

A medium HCA would encompass at least 5,000 acres of old-growth forest with over 8 MBF per acre, including at least 2,500 acres of old-growth forest with over 20 MBF per acre within a tract of at least 10,000 acres. Medium HCA's would be capable of supporting at least five female martens during winters of poor prey (Suring et al. 1992).

Small HCA's would include at least 800 acres of old-growth forest having over 8 MBF per acre within a tract of at least 1,600 acres. Small HCA's would be capable of supporting at least one female marten during winters of poor prey. Small HCA's are maintained to provide temporary functional habitat for wildlife dispersing between large and medium HCA's. The small HCA's also contribute to the landscape matrix between large and medium HCA's.

Within the North Revilla Project Area two blocks of old-growth forest were recommended to the TLMP Draft Revision Planning team (4/91) to be retained as HCA's: in the Traitors Creek drainage (approximately 9,250 acres), and the Orchard Lake/Creek area (approximately 15,050 acres). Also close to the Project Area was the Naha LUD II HCA (approximately 20,160 acres) and the Misty Fiords NM Reserve HCA (approximately 65,500 acres).

Fragmentation and Connectivity

The extinction of species is a serious and irreversible threat to the long-term well being of humans, and habitat loss and fragmentation are prime causes of extinction today. Fragmentation occurs whenever a large continuous habitat is transformed into smaller patches that are isolated from each other, such as occurs from catastrophic windstorms or from extensive clearcutting. The changed landscape functions as a barrier to dispersal for species associated with the original habitat. These smaller and more isolated habitats also support smaller populations, which are more vulnerable to local extinction.

Research shows that forest fragmentation results in an increased ratio of forest "edge" to forest "interior" habitat, and can have a strong negative effect on forest interior

species. One such effect is that as more edge habitat becomes available as a result of fragmentation, the edge-dwelling species invade the interior environment and become a major threat to the survival of the forest interior species. Rosenberg and Raphael (1986) recommended a minimum stand size of 50 acres when delineating old-growth habitat, and suggested that when a stand is greater than 50 percent isolated, the minimum stand size should be 124 acres. By maintaining large contiguous blocks of habitat, the forest interior species would realize less competition and predation from open forest and edge species.

Patch Sizes. The analysis of forest fragmentation in the North Revilla Project Area was based on the total number of old-growth forest patches within specific size classes. Patch size classes were selected to represent MIS requirements based on the species patch size effectiveness curves and HCA recommendations of the VPOP Committee (Tables 3-58 and 3-59; see also box on next page). Old-growth forest patches were defined as the amount of contiguous old growth of Volume Class 4 and above.

Table 3-58
Patch Size Class Relationships

Patch Size (Acres)	Species Relationship
0–25	Incorporates various patch size effectiveness factors
26–100	Incorporates optimal patch size for brown creeper
101–500	Incorporates optimal patch size for marten
501–1,000	Small HCA's, incorporates optimal patch size for woodpeckers
1,001–5,000	Small HCA's, incorporates optimal patch size for deer
5,001–10,000	Medium HCA's
> 10,000	Large HCA's

SOURCE: Workshop to recommend patch size relationship and corridor requirements for the MIS and TES species.

Table 3-59
Patch Size Effectiveness Curve Values by Patch Size Class and by Species

	Patch Size Classes (Acres)						
Species	0–25	26–100	101–500	501–1,000	1,001–5,000	5,001 10,000	>10,000+
Sitka b-t deer	0.3	0.35	0.5	0.83	1.0	1.0	1.0
Marten	0.2	0.5	1.0	1.0	1.0	1.0	1.0
Red Squirrel	0.4	1.0	1.0	1.0	1.0	1.0	1.0
Hairy wdpcker	0.1	0.42	.7	1.0	1.0	1.0	1.0
Brown Creeper	0.8	1.0	1.0	1.0	1.0	1.0	1.0

* Represents the median curve value within each patch size class from the species effectiveness curves.
SOURCE: Workshop to recommend patch size relationships and corridor requirements for the MIS and TES species.

Patch Size and Corridor Requirements of MIS and TES Species

An interdisciplinary group of biologists from ADF&G, Forest Service, and the U.S. Fish & Wildlife Service (1989) categorized management indicator species (MIS) and threatened and endangered species (TES) into one of three groupings based on how the species generally utilize or respond to their environment with regard to needing minimum habitat patch sizes and/or dispersal corridors.

Landscape: Wildlife species in this category generally have large seasonal or year-long home ranges and territories. These species are capable of utilizing a wide variety of vegetative conditions, although preferences for certain vegetation types exist which provide a higher quantity/quality of forage or cover needs. These species will travel or move through a wide variety of habitats to utilize their environment; therefore, these species do not have specific patch size or corridor requirements.

Community: Wildlife species in this category generally have smaller home ranges and territories than the landscape species. These species show a high preference or requirement for a particular vegetation community or combination of communities, especially during the season of the year that is considered critical. Preferred or required habitats may need to be within mean dispersal distances the the species, and corridors may be needed. These species generally show a relationship with patch size of the preferred or required habitats. In some situations, as patch sizes are reduced, a species may be displaced by another species which can more effectively use the habitat.

Structural: Wildlife species in this category require a specific or unique habitat element or site, such as a pond or cliff for nesting. Often, the size, location, and abundance of these sites are the result of natural geologic or climatic events rather than the effects of management.

Each of the MIS and TES species that occurs within the North Revilla Project Area was placed within one of the above groups, as follows:

Landscape	*Structural*	*Community*
Black bear	Bald eagle	Marten
Gray wolf	Trumpeter swan	Hairy woodpecker
River otter	Peregrine falcon	Brown creeper
		Marbled murrelet
		Vancouver Canada goose
		Sitka black-tailed deer
		Red squirrel

For the species within the landscape and structural groups, no specific patch size or corridor requirements are needed. For the species within the community category, the committee identified types of vegetative communities or habitats that are applicable to patch sizes and corridor requirements for each species. These include:

Marten: patch size includes the acres of all conifer stands from older second growth and all CFL old growth; corridor requirements include all conifer stands from older pole timber through old growth.
Hairy woodpecker: patch size includes all old-growth conifer stands plus older second-growth stands; there are no corridor requirements for this species.
Brown creeper: patch size includes all volume class 5+ old-growth conifer stands; there are no corridor requirements for this species.
Marbled murrelet: patch size includes all old-growth conifer stands; there are no corridor requirements for this species, as it has been observed flying in the subalpine and alpine habitats.
Vancouver Canada goose: adequate information was not available to develop patch size relationship for this species. These birds are highly mobile and are found throughout the islands of Southeast Alaska. No vegetative corridor requirements have been identified.
Sitka Black-tailed deer: patch size includes all old-growth stands; no specific corridor requirements were developed.
Red squirrel: patch size includes the acreages of all cone producing stands of conifer trees; corridor requirements include all pole timber or larger or older stands of trees.

The relationship of patch size to the effectiveness of that habitat to support a particular species was analyzed, and index graphs were developed. Table 3-58 displays a summary of the effectiveness of various patch size classes for the above North Revilla MIS species.

Prior to timber harvest (1954), the Project Area contained extensive amounts of unfragmented forest patches that met the criteria of small, medium, and large HCA's (Figure 3-8, map of distribution of forest patches in 1954, later in this section). Approximately 71 percent of the old growth in volume class 4 and above throughout the Project Area was in forest patches greater than 10,000 acres (i.e., large HCA's). Timber harvest under the Long-Term Contract has decreased the acreage in this patch size class from 65,987 acres to 49,505 acres, see Figure 3-8 (1954 condition), and Figure 3-9 (existing condition,alt.1), later in this section.

Fragmentation of existing old growth results in a reduction in the effectiveness of remaining patches as wildlife habitat. Individual species respond to natural and human-induced fragmentation differently; species like brown creepers and hairy woodpeckers can be supported by smaller patches of forest habitat than species such as deer and marten (Proceedings of workshop to recommend patch size relationships and corridor requirements for the MIS and TES species) (Table 3-58).

Patch-size effectiveness percentages for 1954 range from 99.8 percent (brown creepers) to 98.3 percent for deer (Table 3-605). The values for 1993 vary from 99.7 percent effective to 96.5 pecent effective. The greatest difference in percent effectiveness between 1954 and 1993 was for deer.

Table 3-60
Adjusted Habitat Capabilities Based on Patch Size Effectiveness

Species	1954 W/o*	1993 W/o*	1954 With**	1954 Patch Effect %	1993 With**	1993 Patch Effect %
Sitka black-tailed deer	3,206	1,700	3,146	98.3	1,641	.965
Marten	160	144	158	99.0	141	.979
Red Squirrel	76,774	70,793	76,390	99.5	69,519	.982
Hairy Woodpecker	1,470	1,051	1,449	98.6	1,021	.971
Brown Creeper	3,526	1,338	3,519	99.8	1,334	.997

* Without patch effectiveness percent applied.
** With patch effectiveness percent applied.
NOTE: Patch size effectiveness percentages are higher in the FEIS than in the DEIS because areas less than 1,200 feet wide were not deleted.
SOURCE: MIS Habitat Capability Models.

Connectivity. The connectivity, or corridors, between habitat patches in a landscape may be at least as significant to maintaining diversity as the size of the patches (Noss 1983). Forman and Godron (1981) defined corridors as being of four types: (1) line corridors—those which are all edge and possess no interior habitat, (2) strip corridors—those which maintain interior habitat, (3) stream corridors—those bordering a water source, and (4) network corridors—those which intersect and form patterns. Corridors can function as more than one type; for example, when a stream corridor is wide enough to incorporate interior habitat, it also functions as a strip corridor. Forman and Godron's work also highlighted the fact that some interior species will not live in or even migrate through extensive lengths of unsuitable habitat,

and that strip corridors were preferable to line corridors. Management of corridors as well as habitat patches should strive to mimic natural patterns (Noss and Harris 1986).

Important wildlife habitat areas within the Project Area include the Orchard Lake and Creek area and the Traitors Creek drainage. The main corridor between these two blocks has been affected by timber harvest in the Neets Lake/Bluff Lake area.

The main dispersal corridor throughout Revillagigedo Island are thought to be the Orchard Creek and Carroll Creek drainages and have not been affected by timber harvest. The Traitors Creek drainage is connected to this dispersal corridor through a pass in the northeast portion of the Traitors Creek drainage which has had some scattered timber harvest activity.

Another important wildlife habitat area outside of the Project Area is the Naha LUD II area. Connectivity to this area from the Traitors Creek area is along saltwater or up through the Margaret drainage. Both areas have been affected by timber harvest activities.

Effects of the Alternatives

Analysis conducted for the TLMP Draft Revision (1991a) indicates approximately 378,432 acres of old-growth forest would remain distributed throughout the planning cycle (150 years) within the Revilla Island/Cleveland Ecological Province to potentially support viable populations of Management Indicator Species (MIS). All alternatives proposed by this EIS provide areas that would remain connected by existing roadless areas, beach fringe and estuary fringe, stream corridors, and the myriad of oversteepened slopes and other areas unsuitable for timber harvest. Managed stands would change from multi-aged old-growth timber to even-aged stands of timber in early succession/understory colonization stage.

Following clearcut logging of old-growth forest, the stands that subsequently develop are even-aged (Harris and Farr 1974) and tend to contain a higher percentage of Sitka spruce and a lower percentage of the cedars. Clearcutting differs from natural disturbances in that it represents a large-scale change (up to 100 acres, typically) rather than dispersed small (1–20 acres, typically) partially blowdown patches. It also differs in that nearly all trees are felled, whereas in natural disturbances many trees remain standing or partially standing (Hansen et al. 1991).

There has been a national concern over the limited and dwindling supply of old-growth forest, as exemplified by the spotted owl controversy in Oregon and Washington. Approximately 4.6 percent of the old-growth forest in the Revilla Island/Cleveland Peninsula has been harvested. As the TLMP Revision is implemented, approximately 39 percent of the old growth forest in the Revilla Island/Cleveland Ecological Province will be converted from old-growth forest to successive crops of younger trees which will be harvested before they mature into old-growth forest (TLMP Draft Revision 1991a). The subsequent crops of younger trees will yield more useable wood fiber per acre. At the same time, this conversion of old-growth forest to younger stands will cause some changes in the value of certain

forest products, changed value of wildlife habitat, reduced diversity of ecosystem function and composition, and changes in inherent aesthetic qualities. Figure 3-8 displays the amount of old-growth habitat that existed in 1954. The effect of proposed alternatives on existing old growth (Figure 3-9) is displayed in Figures 3-10 through 3-14, and the effect of harvesting the total unit pool is displayed in Figure 3-15.

Fragmentation and Patch Size Effectiveness

To help identify important blocks of old-growth habitat, a map was generated using Geographic Information System (GIS) that displayed all blocks of old-growth timber volume class 4 and greater. The patches were then categorized into the various acreage classes. This procedure was completed for the years 1954 (prior to logging) and 1993 (the current condition, Alt. 1), and for Alternatives 2-6. These patches are displayed in Figures 3-8 through 3-14. Table 3-61 displays the acreage in each patch size class, for the year 1954, the existing condition (1993), and Alternatives 2–6.

While no analysis was performed to assess the portion of forest edge in each block (thereby delineating interior old-growth conditions), the blocks can be compared against each other to form a relative comparison.

Table 3-61
Patch Size Acreage, by Alternative

Alt.	>10,000-Acre Patches	1,000–5,000-Acre Patches	500–1,000-Acre Patches	100–500-Acre Patches	0–100-Acre Patches
1954	65,987	3,797	914	695	1,101
1	49,505	3,460	1,429	950	1,875
2	31,184	8,625	2,600	3,946	2,885
3	34,716	9,353	2,265	2,572	2,711
4	33,241	10,154	1,736	3,545	2,776
5	34,584	7,463	2,944	3,160	2,765
6	32,997	10,118	2,152	2,545	2,990

NOTE: Acreage in the larger patches is greater than in the DEIS because areas less than 1,200 feet wide were not deleted.

Table 3-62 displays the results of patch-size effectiveness for deer, marten, red squirrel, hairy woodpeckers, and brown creepers (the only North Revilla MIS species with patch size criteria requirements). Note that none of the action alternatives are significantly different.

Table 3-62
Adjusted Habitat Capabilities Based on Patch Size and the Percent Effective by Alternative

Species	1954	1 1993	2 1993	3 1996	4 1996	5 1996	6 1996
Sitka b-t deer	3,151	1,641	1,452	1,507	1,492	1,503	1,487
% effective	98.3	96.5	91.2	93.3	92.4	92.3	92.8
Marten	158	141	122	127	129	128	125
% effective	99.0	97.9	96.4	96.7	96.7	96.6	96.4
Red Squirrel	76,390	69,519	69,213	67,946	67,681	68,033	68,281
% effective	99.5	98.2	98.6	98.7	98.8	98.6	98.6
Hairy woodpecker	1,449	1,021	828	870	879	868	858
% effective	98.6	97.1	93.5	94.7	94.2	94.2	94.4
Brown creeper	3,519	1,334	1,125	1,187	1,200	1,191	1,172
% effective	99.8	99.7	99.5	99.6	99.6	99.5	99.5

SOURCE: Matson 1993, GIS database

Effect of Proposed Alternatives on Total Old-Growth Habitat in North Revilla

Figure 3-8 represents the pre-harvest (1954) condition, while Figure 3-9 represents the existing condition (alt. 1), and Figures 3-10 through 3-14 shows the effect that the alternatives would have on the existing large blocks of old-growth forest. Figure 3-15 shows what might remain of the large blocks of old-growth forest if the entire unit pool is harvested. Past timber harvest activity has significantly reduced the amount of old-growth forest in blocks greater than 10,000 acres, causing a corresponding increase in the amount of old-growth forest that is in blocks under 5,000 acres in size. The action alternatives also reduce in the amount of old-growth timber remaining in blocks greater than 10,000 acres.

Figure 3-8
Patch Size Effectiveness, 1954

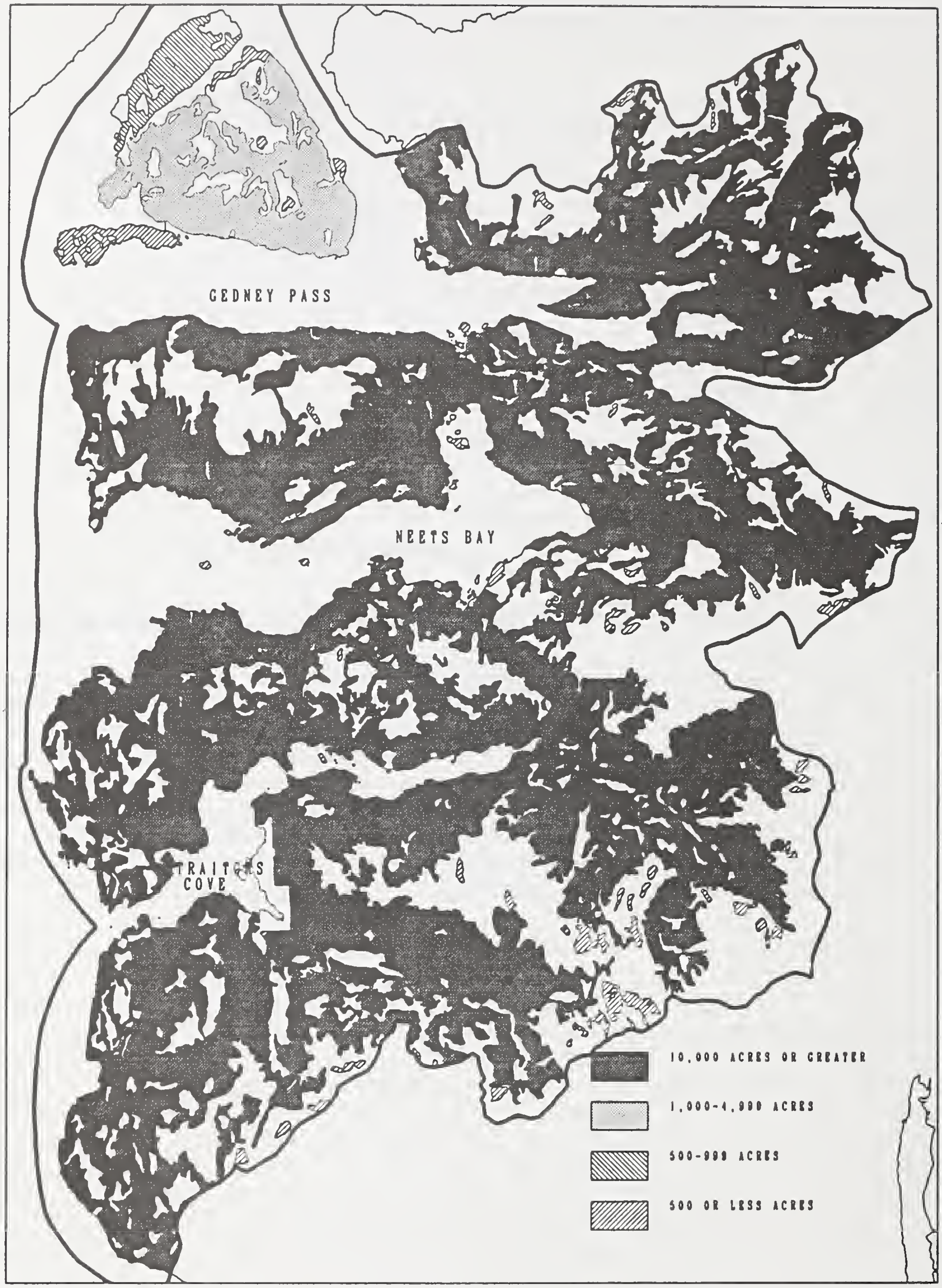


Figure 3-9
Patch Size Effectiveness, Alternative 1

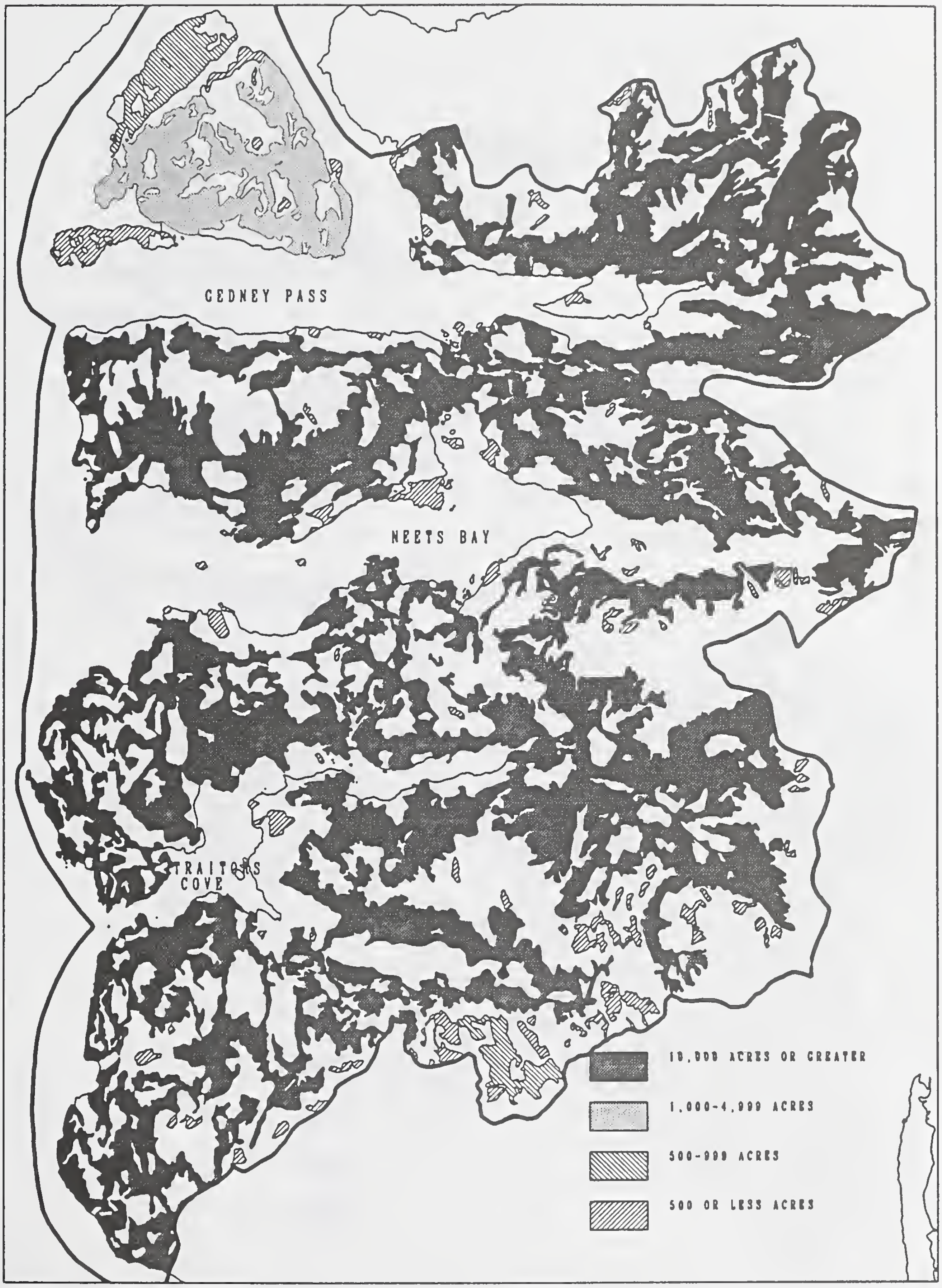


Figure 3-10
Patch Size Effectiveness, Alternative 2

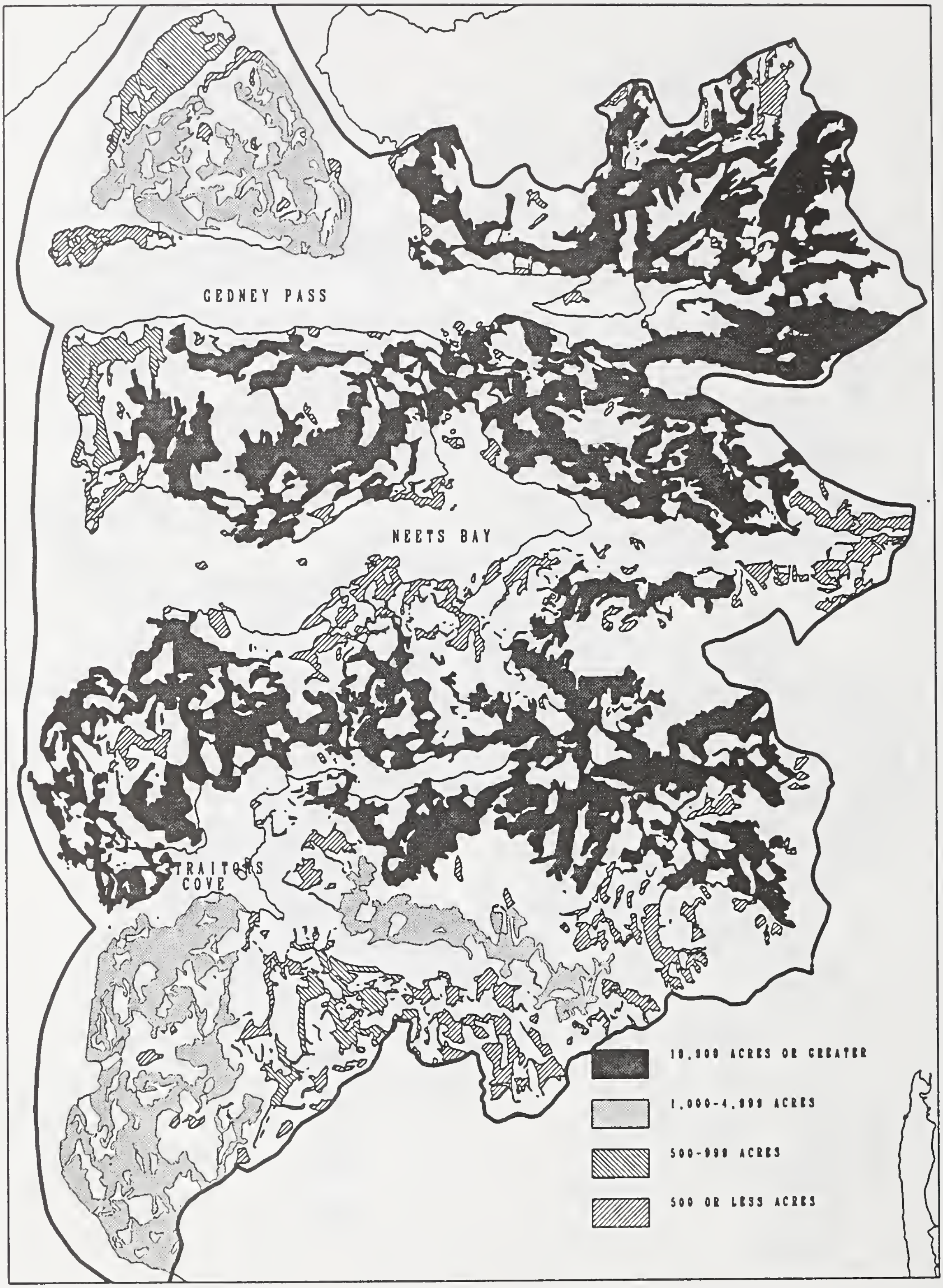


Figure 3-11
Patch Size Effectiveness, Alternative 3

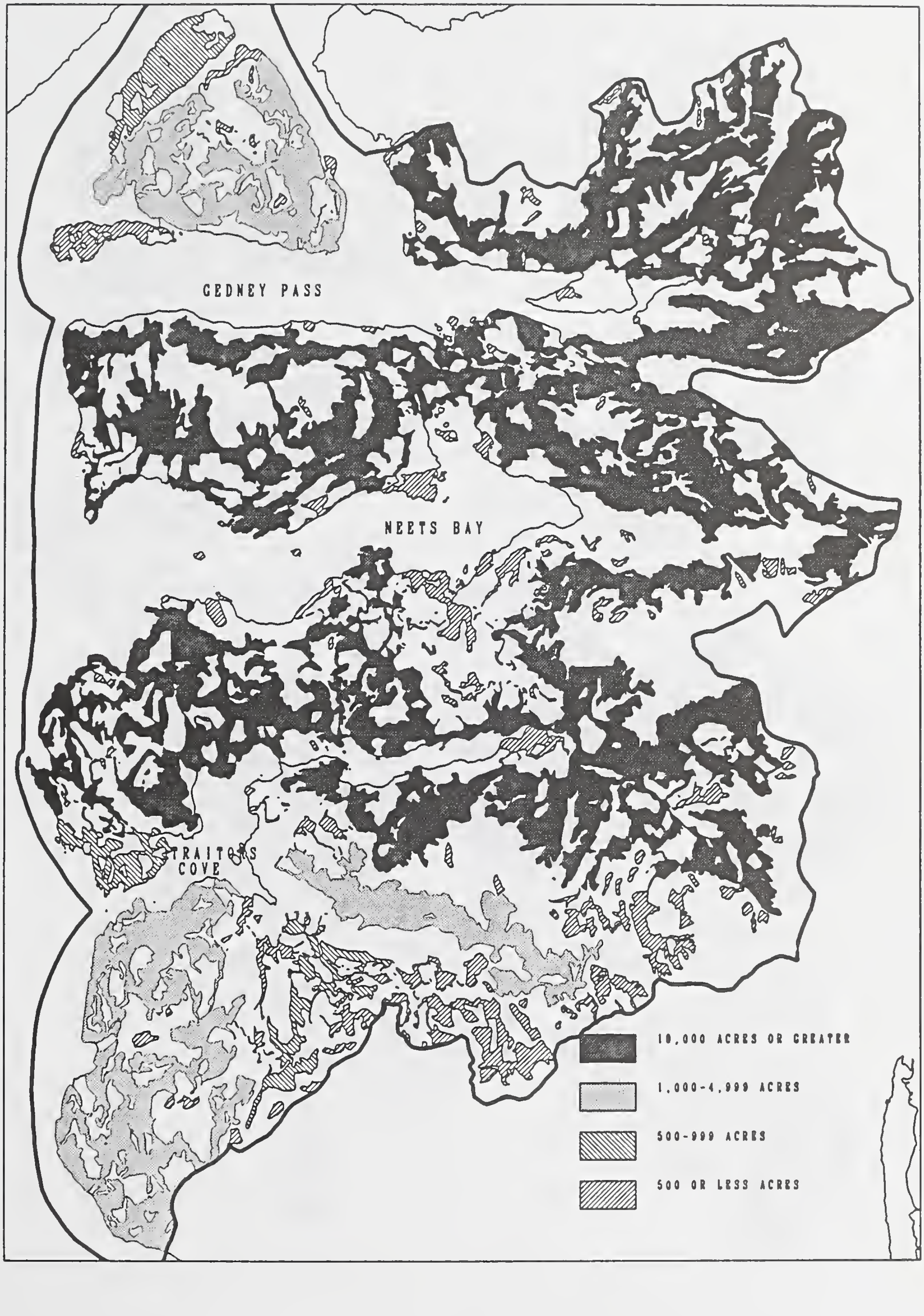


Figure 3-12
Patch Size Effectiveness, Alternative 4

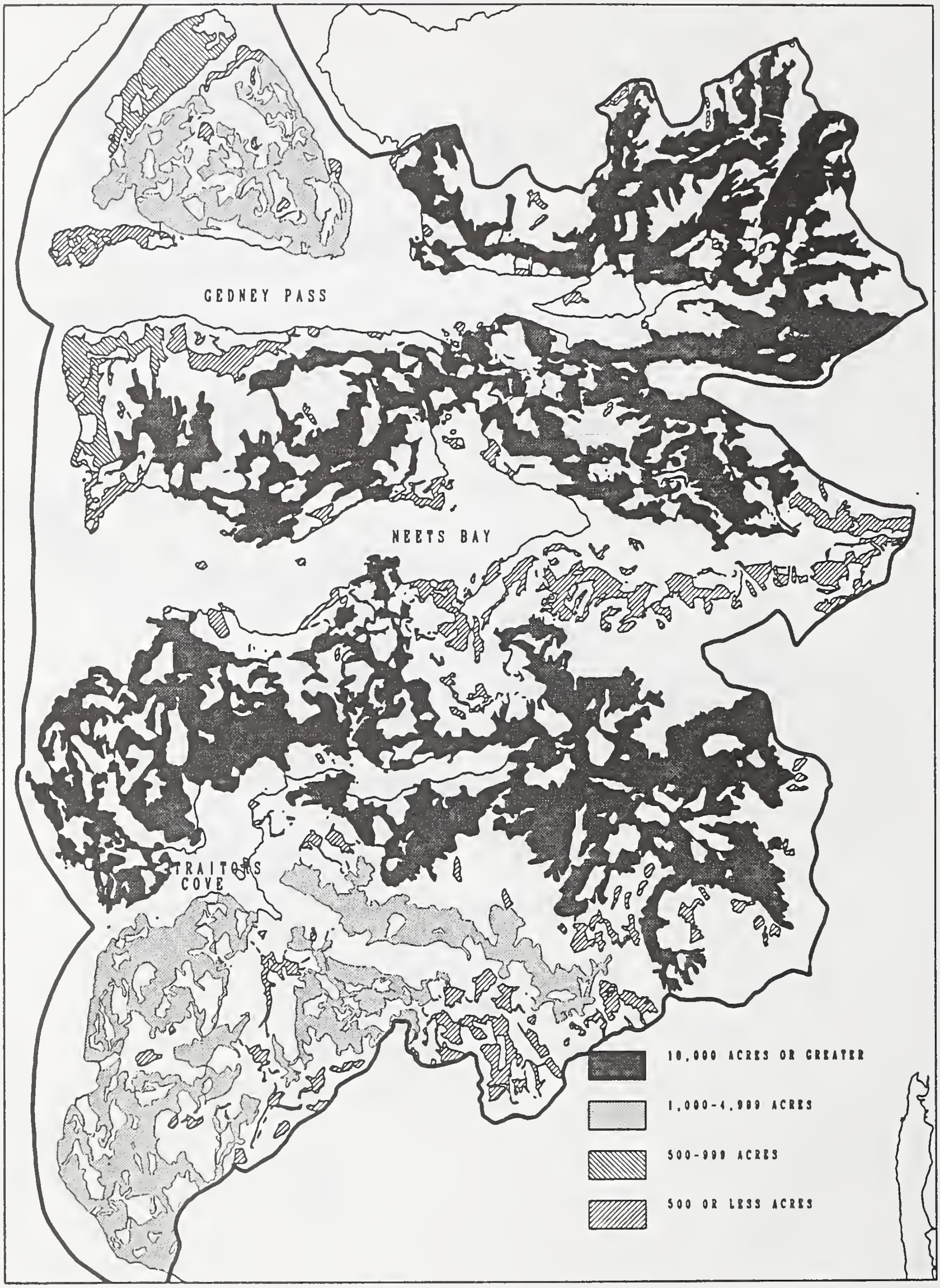


Figure 3-13
Patch Size Effectiveness, Alternative 5

Figure 3-14
Patch Size Effectiveness, Alternative 6

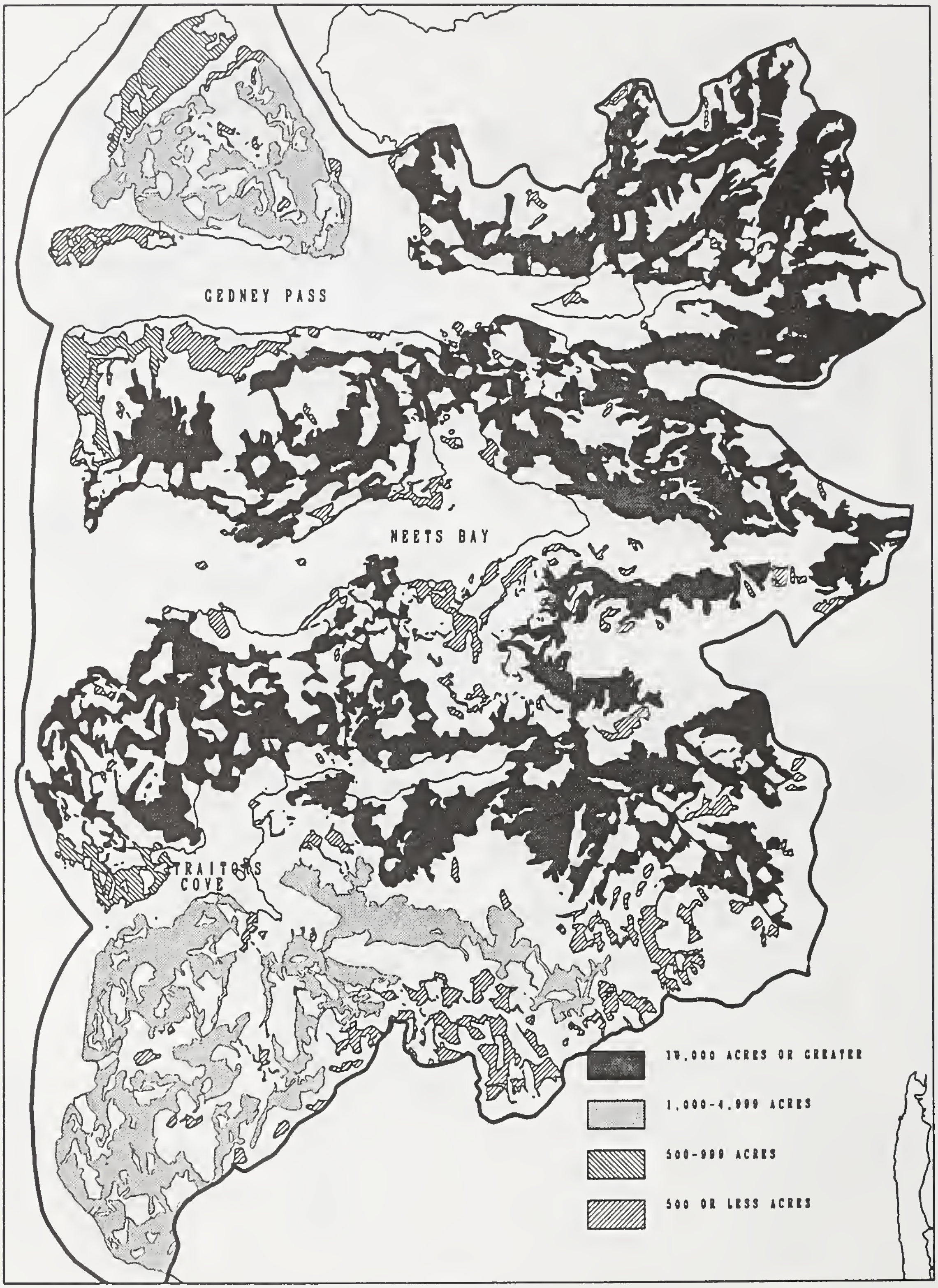
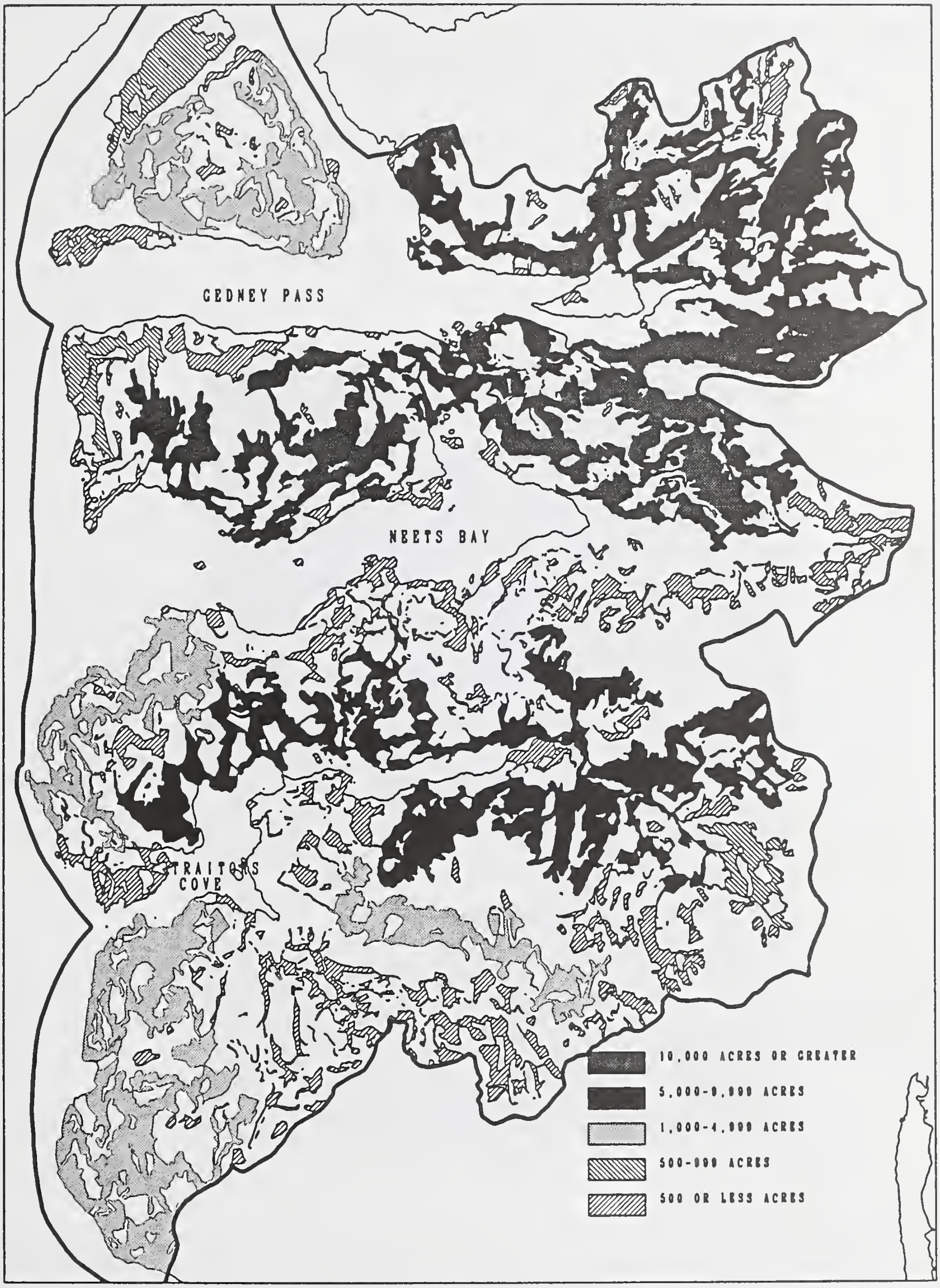


Figure 3-15
Patch Size Effectiveness, Harvest of Entire Unit Pool



Effects of Alternatives on Existing Old-Growth Patches

Table 3-63 displays the alternatives which propose timber harvest within the various patches of old growth forest that exist within the North Revilla Project Area.

Table 3-63
Old Growth Patches Affected by Alternative

Old Growth Patch	1	2	3	4	5	6
Hassler Island		X	X	X	X	X
Klam/Klu Drainage		X	X	X	X	X
North Orchard Lake		X				
Bluff/Neets Lakes		X		X	X	
South Shrimp Bay		X	X		X	
Fire Cove Pass		X		X	X	X
Gedney Pass Peninsula		X	X	X	X	X
North Traitors Cove		X	X		X	X
Traitors Cove Salt Chuck		X	X			
Traitors Creek Headwaters		X	X		X	X
Margaret Lake/Creek Drainage		X	X	X	X	X

SOURCE: Matson 1993.

Effects of the Alternatives on Connectivity and Corridors

Important corridors in the vicinity of Bell Island, Orchard Lake/Creek, and Carroll Creek have not been affected by any of the alternatives.

Due to the patchiness of the existing old-growth forest, timber harvest within certain areas may reduce the effectiveness of those corridors. These areas include the Klam/Klu drainages, Orchard Lake area, Bluff/Neets Lakes area, south Shrimp Bay, Fire Cove Pass, Traitors Cove Salt Chuck, Traitors Creek Headwaters, and Margaret Lake/Creek drainage. Table 3-63 displays the alternatives which propose timber harvest within these corridors. Increasing the amount of timber harvest within a particular corridor, increases the potential of isolating or fragmenting habitat and the corresponding plants and animals. Corridors which have been impacted by past timber harvest activity (beach fringe, Bluff/Neets Lakes area, and Margaret Lake/Creek drainage), may be improved by silvicultural techniques, such as varible spaced thinning.

Effects of the Alternatives on Viable Populations of Wildlife

Forest Plan land allocation on Revillagigedo Island prohibits timber harvest in most of the Habitat Conservation Areas recommended to the TLMP Revision planning team (Misty, Orchard Lake, and Naha LUD II). The only proposed HCA that was not set aside by the Forest Plan was a small HCA in Traitors Cove Salt Chuck/Traitors Creek Headwaters area. The North Revilla IDT proposed a small HCA in the Traitors Cove Salt Chuck area to meet the Interagency Viable Population Committee recommendations for “A Strategy For Maintaining Well-Distributed, Viable Populations of Wildlife Associated With Old-Growth Forests in Southeast Alaska”. Alternatives 4, 5, and 6 do not propose any harvest within the Traitors Cove Salt Chuck HCA.

It is assumed that by maintaining HCA’s which meet the Interagency Committee’s recommendations, the Project Area will contribute to the maintenance of a well-distributed, viable population of wildlife.

Comparison of Alternatives

Based on old-growth habitat and patch size effectiveness, Alternative 1 would do the most to preserve the natural biological diversity of the Project Area and maintain natural ecosystem processes. Of the action alternatives, Alternatives 4, 5, and 6 maintain the most acreage in large old-growth patches. There is not much difference among action alternatives when considering patch size effectiveness, although Alternative 2 has the most impact. Alternatives 4, 5 and 6 do not call for any further fragmentation of the Traitors Cove Salt Chuck HCA.

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THREATENED AND ENDANGERED SPECIES

Key Terms

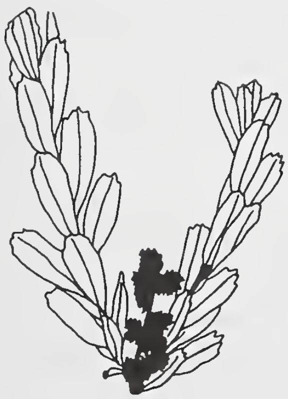
Endangered - A species in danger of extinction throughout all or a significant portion of its range
Threatened - A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range
Category 2 Candidate - A species or group of species being considered by the U.S. Fish and Wildlife Service for listing as endangered or threatened, but for which conclusive data is lacking on its biological vulnerability and degree of threat
Sensitive -Species (identified by the Regional Forester) whose population viability is of concern on national forests within the region, and which may need special management to prevent their being placed on State or Federal threatened and endangered species lists
Haul Out - area of large, smooth, exposed rocks used by seals and sea lions for resting and pupping

Affected Environment

Threatened or Endangered Species

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS), under the authority of the Endangered Species Act of 1973, as amended. Candidate species are those being considered for listing as threatened or endangered by the USFWS and NMFS. The State of Alaska has an Endangered Species Law which authorizes the commissioner of the Alaska Department of Fish and Game (ADF&G) to list Alaska endangered species. The Regional Forester can also designate species as "Sensitive".

Fish



No threatened, endangered, candidate, or sensitive fish species are known to occur in the North Revilla Project Area.

Plants

No plant species known to occur in the Project Area have been determined threatened, endangered, candidate, or sensitive.

Marine Mammals

Humpback whales and Steller sea lions are occasionally found in waters bordering the Project Area (Pennoyer 1992).

Humpback Whale. (listed by NMFS as Endangered) The local distribution of humpbacks in Southeastern Alaska appears to be correlated with the density and seasonal availability of prey, particularly herring (*Clupea harengus*) and euphausiids (shrimp-like crustaceans). Important feeding areas include Glacier Bay and adjacent portions of Icy Straight, Stephens Passage/Frederick Sound, Seymour Canal and Sitka Sound. Other areas of Southeastern Alaska may also be important for humpbacks and need to be evaluated. These include Cape Fairweather, Lynn Canal, Sumner Strait, Dixon Entrance, the west coast of Prince of Wales Island, and offshore banks such as the Fairweather Grounds, none of which are within the Project Area.

Steller Sea Lion. (listed by NMFS as Threatened) The Steller sea lion ranges from Hokkaido, Japan, through the Kuril Islands and Okhotsk Sea, Aleutian Islands and central Bering Sea, Gulf of Alaska, Southeast Alaska, and south to central California. Currently, information on Steller sea lion population trends in Southeast Alaska is limited. However, available information suggests that Steller sea lion populations are stable in Southeast Alaska. There are no known Steller sea lion haul out areas identified in the Project Area, although they may occasionally be seen swimming in Behm Channel.

Other Wildlife

The endangered American peregrine falcon may migrate through the North Revilla Project Area, as well as the Eskimo curlew and the Aleutian Canada goose (Holmberg 1992). No other endangered or threatened wildlife species are known to occur in the Project Area (Holmberg 1992). Four days have been spent checking for the presence of the Spotted Frog and none were found within the Project Area.

Candidate and Sensitive Species

Within the North Revilla Project Area there are two species which are classified as category 2 candidate species (Northern Goshawk and Marbled Murrelet) and one species classified as sensitive (Trumpeter Swan).

Marbled Murrelet

The marbled murrelet is a robin-sized seabird that is found throughout the North Pacific; the North American subspecies ranges from Alaska's Aleutian Islands to central and occasionally southern California. The marbled murrelet feeds in near-shore ocean feeding areas, inland saltwaters, and occasionally inland freshwater lakes. The bird feeds below the water's surface on small fish and invertebrates.

Based on miles of shoreline having food resources and appropriate nesting area, Alaska is the major center of the marbled murrelet population in North America (Marshall 1988). Population estimates for Southeast Alaska range from 75,000–150,000 (McAllister cited by Mendenhall 1992) to 250,000 (Kessell and Gibson 1978, cited by Marshall 1988). Descrepancies between population estimates can only be resolved by systematic surveys (Mendenhall 1992).

The marbled murrelet is currently listed as a category 2 candidate species in Alaska. The U.S. Fish and Wildlife Service has listed the marbled murrelet as threatened in Washington, Oregon, and northern California. The Pacific Northwest and Southeast Alaska, the bird normally nests in old-growth forests, however, a ground nesting marbled murrelet has been discovered on Prince of Wales Island (Thorne Bay Ranger District, 7/23/93).

Marbled murrelet habitat requirements are not well established for Southeast Alaska, and there is a need for research on both nesting and foraging habitat requirements as well as mortality factors such as oil spills, fishing nets and predation. However, the available information indicates that habitat for regional marbled murrelet populations is probably adequate (see the Biological Assessment in Appendix D).

Interim Standards and Guidelines for marbled murrelets call for leaving a minimum 30-acre windfirm buffer around all nests discovered, so that the nesting site can be studied in order to gain a better understanding of the nesting habitat requirements of marbled murrelets in Southeast Alaska.

Northern Goshawk

The goshawk is a raven-sized raptor associated with forests having tall trees and dense canopies. These features allow goshawks to hunt beneath the tree canopy, and to capture prey before the prey escapes into the trees or shrub layer. The dense canopy in tall trees fosters a more abundant prey species population and provides a microclimate suitable for nesting. Goshawks forage over home ranges that are typically 6,000 to 8,000 acres, though home range may be twice that size in fragmented forests (C.Crocker-Bedford 1991).

The northern goshawk has been listed as a category 2 candidate species for all of its range, including the Queen Charlotte subspecies which is present in Southeast Alaska. A status review is expected to be completed sometime during 1993. On August 18, 1992, Interim Guidelines for Goshawk Habitat Management were adopted by the USDA Forest Service Region 10. A review and evaluation of the guidelines is occurring.

The current guidelines for Northern Goshawk Management Areas consist of three components:

Nest Area (NA)–includes the nest, nest tree, and approximately 30 forested acres surrounding the nest tree. Habitat management guidelines recommend no vegetation manipulation within the Nest Area and no prolonged mechanical activity within 600 feet of active NA's from March 15 to September 1.

Post Fledging Area (PFA)–includes approximately 600 acres of contiguous forest around the nest area which have the potential to be habitat that is highly used by fledglings. Timber harvest can occur within this zone, but should be planned in less important habitat types, and openings resulting from timber harvest should not be greater than 20 acres in size and 600 feet in width.

Foraging Area (FA)–includes approximately 6,000 acres around the NA that is used by young and adult goshawks to meet their food requirements. At least 20 percent of the FA should be in stands that provide important habitat structure (large trees with dense overhead canopy).

Inventories were conducted in the Shrimp Bay, Traitors Cove, Hassler Island, and Margaret Lake areas from 1990 through 1993. No known goshawk nests have been found, however, two confirmed sightings were made above the Margaret watershed in 1990 (Crocker-Bedford, 1990) and in the Hassler Pass Area (Hassler Island and Curlew Point) by ADF&G goshawk research biologists in April of 1993..

Sensitive Species

Trumpeter Swan

The trumpeter swan is classified as a sensitive species in Forest Service Region 10. The swan is the largest waterfowl species in the world. Its present range is only a vestige of the once vast region of North America that it frequented in both summer and winter (Bellrose 1980). Trumpeter swans breeding in Alaska spend the winter along the Pacific Coast from the Alaska Peninsula to the mouth of the Columbia River, where they take advantage of open waters of saltwater estuaries and freshwater lakes and rivers. Trumpeter swans are present in the Project Area primarily during the fall and early spring migration periods and during winter.

Klu Bay, Neets Bay, Margaret and Orchard lakes area are resting stops for swans in the Project Area.

Effects of the Alternatives

Threatened or Endangered Wildlife Species

Proposed actions in each of the alternatives are not anticipated to adversely affect, directly, indirectly, or cumulatively the humpback whale, Steller sea lion, American peregrine falcon, Aleutian Canada gosse, or the Eskimo curlew. A biological assessment is included in Appendix D. The biological assessment determined, and the National Marine Fisheries Service (Pennoyer 1993) and the U.S. Fish and Wildlife Serive (Holmberg 1993) concurred, that the proposed project is not likely to affect these species.

Humpback Whale

Two types of boat activity associated with LTF's—log raft towing and recreational boating by workers—may have an effect on whales. Log raft towing frequency would vary between camps, seasons, and years; a general average may be about once a week during the working season (U.S. Forest Service, 1989-94 Operating Period for the KPC Long-term Contract). The speed and direction of tugs and recreational boats may affect whale behavior; however, log raft towing routes are generally well established, and adverse effects from log raft towing have not been documented.

Recreational boating activity would vary between seasons and years from the community of Ketchikan. The effect of such recreational activity on whales would depend on factors such as size of the bay, depth of the waters in the bay, number of boats, and individual behavior responses of the whales. There currently is not a quantifiable way to estimate these possible effects.

No direct or indirect effects on whales from implementation of forest management activities are anticipated. Forest-wide standards and guidelines have been developed to prevent and/or reduce indirect effects due to Forest Service permitted or approved activities. The following standards and guidelines have been developed for application on all Forest Service permitted or approved activities to provide for the protection and maintenance of whale habitats.

1. Avoid intentional aircraft flights below 500 feet above-ground level in the known vicinity of whales on Forest Service permitted or approved activities, when weather ceilings permit.

2. Avoid intentional approach in a vessel of 100 feet or more in length to within 0.25 mile of whales on Forest Service permitted or approved activities, when safe passage exists.

3. Avoid intentional approach in a vessel of less than 100 feet in length to within 100 yards of whales on Forest Service permitted or approved activities, when safe passage exists.

Steller Sea Lion

Proposed actions in each of the alternatives are not anticipated to adversely affect directly, indirectly, or cumulatively, Steller sea lion populations. No areas within the Project Area have been listed by NMFS as critical habitat.

Forest-wide standards and guidelines have been developed to prevent and/or reduce indirect effects of harassment or displacement of marine mammals due to Forest management activities. These guidelines will be followed.

Category 2 Candidate Species

Marbled Murrelet

All action alternatives will harvest stands capable of providing nesting habitat (old-growth forests) for marbled murrelets. Table 3-46 in the Wildlife section of this chapter shows that Alternatives 2, 3, 4, 5, and 6 harvests 14 percent, 10 percent, 10 percent, 11 percent and 12 percent respectively, of the old-growth habitat in the Project Area.

Based on current information, a reduction in available nesting habitat may occur. However, because of the many large unroaded blocks of habitat that exist in and adjacent to the Project Area (Misty Fiords National Monument–2,136,000 acres; Cleveland Peninsula–250,000+ acres; Orchard Lake–10,000 acres; and the Naha River area–20,000 acres), the regional population of marbled murrelets is not anticipated to be adversely affected. Any nests located during field reconnaissance or unit layout will be protected from timber harvest and blowdown with a minimum 30 acre buffer, so that the nesting site can be studied in order to gain a better understanding of the nesting habitat requirements of marbled murrelets.

Northern Goshawk

There have been two confirmed sightings of goshawks about one mile north of Margaret Lake and on Hassler Island, which implies that breeding home ranges may be in those vicinities. Goshawk surveys have been few, so other breeding home ranges may also occur in the North Revilla Project Area.

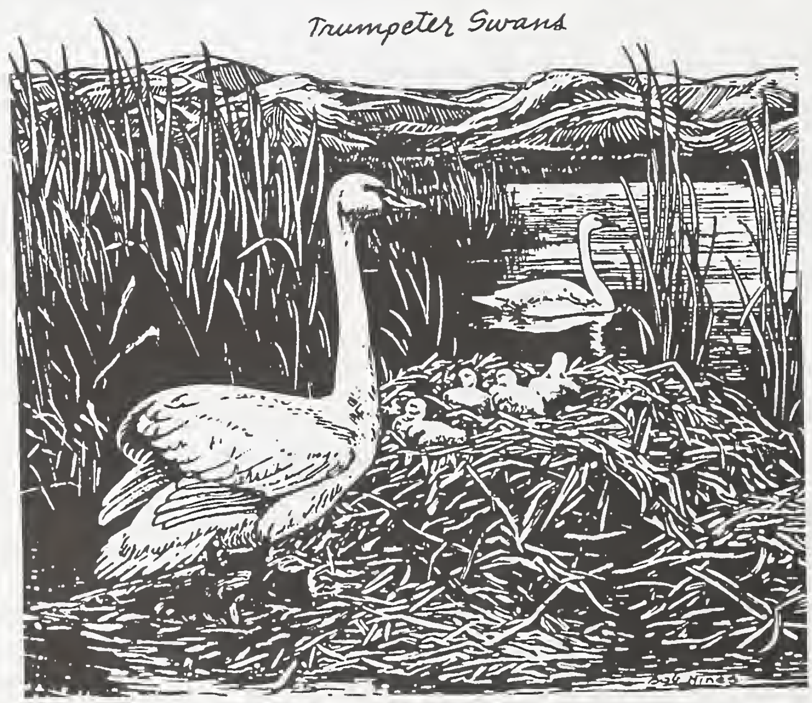
Any goshawk nests found during field recon or unit layout will be protected from harvest in all areas, following the current Guidelines for Goshawk Management.

Sensitive Species

Trumpeter Swan

Most timber harvest activity will not be in conflict with the TLMP Draft Revision (1991a) standards and guidelines for trumpeter swans, since swans are not present in the Project Area when most of the timber harvest activity occurs. There is a potential for conflict when swans are migrating through or returning to wintering areas on Margaret, Bluff, Elizabeth, and Orchard lakes, the upper end of Margaret Bay and Traitors Cove salt chuck, the Naha River outlet and Neets and Klu Bay. Noise from road construction, timber harvest, and hauling of logs could frighten swans away from their preferred resting and feeding areas. However, limiting timber harvest operations to periods when swans are not present (April 1 through November 1) will mitigate these potential impacts for the units that are within a half mile of Margaret, Bluff, Elizabeth and Orchard Lakes, the upper end of Margaret Bay and Traitors Cove salt chuck, and Neets and Klu Bay (see Mitigation Measures, Chapter Two). The following units are located within 0.5 miles of these areas:

3005	8001	9008
3006	8009	9041
3010	8011	9047
3012	8070	9048
3016	8071	9053
3037	9000	9056
9103		



FOREST HEALTH

Key Terms

Endemic - peculiar to a particular locality; indigenous
Epidemic - rapid spread or sudden prevalence of a disease
Phloem - the tissue in plants that conducts foods such as sugar
Xylem - the tissue in plants that conducts water and substances in solution
Sapwood - the softer part of wood, between the inner bark and the heartwood

Affected Environment

Forest insects and diseases are normal components of the forested sites in the North Revilla Project Area. Some of them exist, and will continue to exist, at endemic levels. Even at low levels of infestation or infection, forest insects and diseases have considerable effects on forest dynamics and resource management values. When they proliferate and become epidemic, the consequences to the forest can be dramatic. Currently there is no indication that insects or diseases are a potential problem in the North Revilla Project Area.

Insects

The two most common types of destructive insects found in the North Revilla Project Area are defoliators and bark beetles.

Forest Defoliators

Forest defoliators eat the leaves or needles of forest trees. Unlike bark beetles, defoliators usually do not kill trees but slow down tree growth and increase susceptibility to secondary attack by other insects and diseases. All species of trees are not equally susceptible to injury from defoliation. Hardwood species can usually withstand several years of defoliation because they store large food supplies and can refoliate in the same year. Conifers, on the other hand, may be killed by a single defoliation if it occurs prior to bud formation in midsummer.

The two most common forest defoliating insects that occur within the Project Area at endemic levels include the following.

Black-headed budworm, *Acleris gloverana* (Wals) is one of the most destructive forest insects in coastal Southeast Alaska. In the 1950's, almost one-third of the net timber volume was lost on some hemlock sites due to budworm defoliation. Larvae usually confine their feeding to new growth. In large concentrations, the larger larvae will feed on older needles. Budworm defoliation can result in growth reduction,

top-kill, and, at times, tree mortality. Budworm populations are characterized by sporadic spectacular increases followed two to three years later by equally rapid declines.

Hemlock sawfly, *Neodiprion tsugae* (Middleton) is a serious defoliator of western hemlock throughout Southeast Alaska. Outbreaks tend to be more severe and of longer duration in the area south of Frederick Sound, especially along Clarence Strait. Larvae feed on mature foliage rather than the current year's foliage. Most sawfly outbreaks do not cause tree mortality, but some trees are top-killed and radial growth may be reduced. Tree mortality becomes more likely when sawfly and black-headed budworm populations coincide. This is due to the feeding habits of the two defoliators; the budworm feeds on the current year's foliage, whereas sawflies consume previous years' foliage. Natural controls usually reduce epidemic sawfly populations within a few years. Wetter than normal summers help reduce sawfly populations by favoring conditions for fungal growth. Fungi readily infect and kill sawfly larvae under warm, damp conditions. Low summer temperatures can also delay sawfly development and reduce the opportunities for successful egg laying. Eventually starvation and poor nutrition brought about by depletion of the host foliage will also contribute to the population collapse.

Bark Beetles

Bark beetles are probably the most destructive forest insect in Alaska. Bark beetles prefer to breed in weakened host material. However, during favorable climatic periods for beetle development, populations may build up rapidly and healthy trees are successfully attacked. Bark beetles girdle the phloem which, in turn, disrupts the downward movement of nutrients. Some bark beetles, notably those of the genus *Dendroctonus*, have a symbiotic relationship with blue-stain fungi. The blue-stain fungi can completely penetrate the sapwood within a year. The fungi plug up the outer conducting tissues in the xylem which halts upward water movement. This action, plus that of the bark beetles, causes the death of a host tree.

Spruce beetle, *Dendroctonus rufipennis* (Kirby) outbreaks have been noted across the Tongass National Forest and adjacent lands in previous years. The spruce beetle life cycle is two years, with adult beetles emerging in late May to early June in search of susceptible host material (spruce logs). Dispersing adults can fly for long distances, over seven miles nonstop. Adult mortality during dispersal is quite high. Female beetles are attracted to windthrow and other downed material. Beetles prefer to attack the sides and bottoms of downed material because of favorable temperature and moisture regimes for brood development. Males are attracted to the site via airborne chemicals produced by the female beetles.

Most outbreaks originate in blowdown or logging residuals (cull logs) and spread to adjacent standing timber. Mortality in unmanaged Sitka spruce stands varies and can be as high as 75 percent.

Diseases

Some of the more common diseases and other forms of damage are discussed below.

Hemlock dwarf-mistletoe, *Arceuthobium tsugense* (Rosendhal, G.N. Jones) is a destructive disease of western hemlock throughout the Project Area. Infestation levels vary in old-growth hemlock stands. Dwarf-mistletoe is absent in some stands, and in other stands almost every hemlock is infected. The volume of western hemlock trees heavily infected with dwarf-mistletoe can be reduced as much as 50 percent over a 100

year period. Dwarf-mistletoe is species specific and rarely infects Sitka spruce and mountain hemlock.

The spread of dwarf-mistletoe in young hemlock stands is often the result of leaving standing infected hemlock in cutover areas (TLMP Revision SDEIS). Dwarf-mistletoe responds to light with increased seed production. Rates of spread to adjacent and lower canopy trees will increase in partial cuts where infected hemlocks remain.

Other

Alaska yellowcedar decline, which leads to reduced growth and eventual death of Alaska yellowcedar, is a widespread problem throughout the Project Area. This decline is associated with wet, poorly drained sites, and recent research has demonstrated that the primary cause of decline cannot be attributed to any contagious organism (TLMP Revision SDEIS). Since it is not contagious, Alaska yellowcedar decline will not spread to sites where it is not found now (TLMP Revision Supplement Draft EIS, pg. 3-117). Because Alaska yellowcedar has high timber value, this annual mortality represents a significant loss in timber value. In addition, substantial acres of old-growth cedar forests have been harvested and are regenerating to other species. The regeneration of Alaska yellowcedar needs to be specifically considered, where it forms a significant component of a site proposed for harvest.

Hemlock fluting results in deeply incised grooves and ridges that extend vertically along the trunk of the tree. This condition reduces the value of hemlock logs because they yield less sawlog volume and because some of the milled wood contains bark. The cause of hemlock fluting is not completely known, but is believed to be genetically controlled. Some sites are heavily affected, to the point of making the stand unsaleable, while other sites have relatively light or no damage.

Decays that affect the stem and root systems are probably the major cause of volume loss within the Project Area. Many decay fungi enter through tree wounds. The accidental wounding of trees during partial cuts and commercial thinnings will increase the impact from decay organisms in managed stands.

Trees are susceptible to a sequence of diseases at different stages of their growth. Early susceptibility thins a forest stand resulting in more vigorous crop trees. In turn, late susceptibility removes the older and more decadent trees, making room and preparing the way for new trees.

Effects of the Alternatives

Specific pests will be affected differently by each of the alternatives. In general, increasing timber harvest will decrease the impacts of the spruce beetle and timber volume loss by pests such as wood decay fungi and hemlock dwarf mistletoe. From the perspective of timber management, the health of the forest is increased through timber harvesting. However, many of these pests also contribute significantly to ecosystem diversity and long-term stability in old-growth stands by providing increased canopy diversity and animal habitat, and by causing the formation of small scale gaps.

In general, endemic levels of insect and disease activity in mature and overmature forests will be allowed to run their course. Tree losses will be accepted. Salvage

logging that exceeds the intent of "minor changes" as defined under the timber sale contract and or direct control measures will require additional NEPA analysis prior to implementation. The action alternatives all have the same relative environmental consequences from a pest management standpoint regardless of whether viewed from a timber production or a biodiversity perspective.

The previous statement is true as long as the range of silvicultural systems applied remains constant across all alternatives. Partial cuts that retain overstory trees will result in western hemlock (the most tolerant species) forming a much larger percentage of the future stand composition. Sitka Spruce, western redcedar, and Alaska yellowcedar occurrence in these sites would be greatly reduced. Partial cutting would increase dwarf-mistletoe infection. Unless a large investment were made to sanitize the stand (remove infected trees) periodically, the future value of the site for timber production could be reduced or even eliminated from an economic standpoint.

SILVICULTURE AND TIMBER

Key Terms

Commercial Forest Land (CFL) - land that is capable of producing continuous crops of timber (20 cubic feet of tree growth annually, or at least 8 MBF)
Desired Future Condition or Goal - a concise statement that describes a desired future condition normally expressed in broad, general terms that are timeless, in that there is no specific date by which the goal is to be achieved (36 CFR 219.3)
Duff Layer - vegetative material covering the mineral soils in forests including the fresh litter and well-decomposed organic material and humus
Even-aged - management techniques that result in the creation of stands in which trees of essentially the same age grow together
Managed Stand - a stand of trees in which stocking level control is applied to achieve maximum growth
MBF - thousand board feet
MELP - Multi Entry Logging Plan - interdisciplinary design and mapping of all potential timber harvest units, including associated logging and transportation systems, within a Project Area
Mid-market analysis - the value and product mix represented at the quarter in which the pond log value (end-product selling price less manufacturing cost) for the species and product mix most closely matches the point between the ranked quarters of the Alaska Index Operation pond log value, adjusted to Common Year Dollars, where one half of the harvest of timber from the Tongass National Forest has been removed at higher values and one half of the timber has been removed at lower values, during the period from 1979 to the current quarter (FSH 2409.22 R10 Chapter 531.1-2).
MMBF - million board feet
Partial cut - method of harvesting trees where any number of live trees are left standing in any of various spatial patterns; not clearcutting
Reserved - lands that have been withdrawn from the timber base by an Act of Congress, the Secretary of Agriculture, or the Chief of the Forest Service
Uneven-aged - management techniques that results in the creation of stands that exhibit a range of diameter or age classes
Windfirm Trees - that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features
Windthrow - the act of trees being uprooted by the wind—three types of windthrow include: endemic where individual trees are blown over, catastrophic where a major windstorm can destroy hundreds of acres, and management related, where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow

Silviculture: Affected Environment

Introduction

Ecosystem Management and New Perspectives are new terms that emphasize an old concept, which incorporates management by objectives with due consideration for biological, physical, and ecological factors. The salient points are two-fold: 1) management of the forest resources must consider a full range of resource objectives (not only commodity outputs), and 2) management must be practical and achievable. The second objective (the physical and biological limitations) serves to restrict the range of treatments and objectives that can be achieved on a particular site. Choices are based on matching the attributes of the silvicultural systems with specific management objectives, and the ecological characteristics for specific stands.

Silviculture can be defined as the theory and practice of manipulating forest vegetation–that is, controlling the establishment, composition, and growth–to meet various resource objectives in a manner that is biologically, ecologically, and environmentally sound, cost effective, and socially and politically acceptable. Management objectives may include aesthetics, water quality, fisheries, timber, wildlife, or recreation. Wood production may or may not be a primary objective.

Silvicultural systems are used to manage forest stands. A stand is a forest community possessing sufficient uniformity in composition, age, spatial arrangement or condition, to be distinguishable and capable of being mapped from adjacent communities. A silvicultural system is a program of treatments throughout the life of the stand; it is the process by which the stand is grown for a specific purpose and it is the means of reaching a desired future condition. This process includes the harvest or regeneration of the stand, intermediate cuttings, and other cultural treatments necessary for the replacement and development of the forest stand. No single silvicultural system can produce all desired combinations of products and amenities from a particular stand or Project Area. Silvicultural systems are applied through prescriptions, which are written records of the examination, diagnosis, and treatment regimes prescribed for the stand. Prescriptions are prepared and written by a certified silviculturist.

Plant Series

The natural vegetation of the North Revilla Project Area is a mosaic of coniferous forest interspersed with alpine tundra, muskeg (bog), shrubland, estuarine, and beach fringe plant communities. The Project Area has been classified into forested plant associations that are based upon the climax plant community (DeMeo 1989). The climax plant community is the result of the interaction between landform, climate, and soils. All forested plant associations having the same climax tree(s) are referred to as a series and are named based upon the climax tree(s). The North Revilla Project Area has seven plant series. Forested plant communities, displayed by VCU in Table 3-50, are described below.

Forested Plant Communities

Sitka Spruce Series Plant associations in this series are generally associated with riparian areas and disturbed sites such as stringers between avalanche chutes. This series can also occur in combination with mountain hemlock at higher elevations. Sitka spruce is the dominant overstory tree species, but western hemlock can be a co-dominant. Red alder may also be present. Common shrub species include devil's club, blueberry, and salmonberry. Ferns and skunk cabbage are the dominant herbs.

The Sitka spruce series is generally highly productive, and the heights of mature spruce often exceed 150 feet.

Western Hemlock Series This series has comprised the majority of sites harvested to date on the Project Area. Plant associations in this series generally occur in the uplands on mountain-, hill-, and foot-slopes with moderate to well drained soils. The predominate overstory tree species is the western hemlock, but Sitka spruce occurs in the overstory in relation to the frequency of disturbance. The shrub layer is dominated by blueberry and rusty menziesia; devil's club, however, can be a major component in some areas. Bunchberry and five-leaf bramble dominate the herb layer, but skunk cabbage can be a major component in areas with poorly drained soils. Plant productivity is generally high, with mature hemlock often exceeding heights of 125 feet.

Most sites harvested to date on the Project Area have been of the Western Hemlock Series

Mountain Hemlock Series These plant associations are generally found on cold high-elevation sites above the western hemlock series. Mountain hemlock is the dominant overstory tree species, with Sitka spruce and yellowcedar occurring to a lesser degree. The shrub layer is dominated by blueberry. As the alpine (treeless) zone is approached, copperbrush and cassiope become more common. Deer cabbage is a common herb. Plant productivity is limited by the shorter growing season at high elevations and by reduced soil drainage common to some of the associations.

Mixed Conifer Series Mixed conifer associations designate sites with limited productivity due to poor soil drainage or shallow soil, or both. These plant associations generally occur in the uplands, often near muskegs. Dominant overstory tree species are mountain hemlock, western hemlock, western redcedar, and yellowcedar. Sitka spruce and shore pine can also occur. Blueberry and rusty

menziesia are the dominant shrub species. Dominant herbs vary and include skunk cabbage, five-leaf bramble, deer cabbage, and ferns.

Western Hemlock-Yellowcedar Series This series can be considered a subset of the western hemlock series on the Ketchikan Administrative Area. It is most common on mountains and hillslopes around 1,000 feet elevation, but can be found from sea level to the subalpine zone. Dominant overstory tree species are western hemlock and yellowcedar; western redcedar may also be present. Blueberry is the dominant shrub, with rusty menziesia common. Dominant herbs vary and include ferns, bunchberry, dogwood, skunk cabbage, and five-leaf bramble. Site productivity is best described as moderate.

Western Hemlock-Western Redcedar Series This series represents a transition from the less productive, more poorly drained mixed conifer series, to the more productive, better drained western hemlock series. It occurs on a wide variety of landforms, but is most characteristic of rolling hill country, and lower hill- and mountain-slopes. Near the northern limit of its range, redcedar growth is limited by light and temperature. Consequently, while it may be found up to 1,000 feet above sea level, it is most common below 500 feet.

The overstory is dominated by western hemlock. Redcedar commonly occupies 10 to 25 percent of the forest canopy. Yellowcedar may also occur. Other species are incidental. The understory is characterized by blueberry, although salal may be locally common on warmer sites below 500 feet elevation. Site productivity is typically low to moderate on rolling hills and moderate to high on hill- and mountain-slopes.

Shore Pine Series This group of associations is on the transition line from mixed conifer to nonforest muskeg. Soils are poorly drained and productivity is very low. Understory vegetation, because of the abundant light available, is very diverse. Muskeg plants such as Labrador tea, crowberry, bog kalmia, bog blueberry, and sedges are common. Salal may occur on some sites.

Table 3-64 displays the approximate percent of area occupied by each plant series found in the North Revilla Project Area.

Table 3-64
Percent of Forested Plant Communities (by VCU and Percent)

VCU	Sitka Spruce	Western Hemlock	Mountain Hemlock	Shore Pine & Mixed Conifer	Western Hemlock Alaska Cedar	Western Hemlock Western Redcedar	Total Forested Land
732	1	27	16	9	4	28	85
733	3	26	14	15	4	28	90
735	1	38	8	26	3	22	98
736	3	37	11	22	2	23	98
737	3	28	14	14	3	27	89
738	3	29	12	29	3	19	95
739	5	23	20	15	4	26	93
740	1	26	13	43	4	12	99
Ave	3	29	14	21	3	24	94

SOURCE: Nightingale, 1992
Note: This information derived from Ketchikan Area GIS, CLU data layer.

Nonforested Plant Communities

Various nonforest plant communities occur in estuaries, riparian areas, muskegs, alpine meadows, and alpine lichen rock outcrops in the North Revilla Project Area. Nonforested plant communities, displayed by VCU in Table 3365, are described below.

Estuary Tidal Flats Nonforest wetlands are described in DeMeo and Loggy (1989). Estuary tidal flats are inundated by high tides. Vegetation consists primarily of sedges, red fescue, and sea milkwort. Bluejoint and sedges dominate on low terraces, which are rarely inundated by tides but have high water tables. This also includes unvegetated mud flats.

Shrub Riparian Areas Shrub riparian areas are found on highly active floodplains and are frequently disturbed. Soils are generally deep and well drained, but flood frequently. Salmonberry, stinkcurrant, devil's club, and ferns are the dominant vegetation.

Muskegs Muskegs are most often characterized by stunted yellowcedar and shore pine, along with sedges and other bog vegetation. Muskegs dominated by sphagnum moss or tall sedge cover smaller areas. The water table is at the surface, and numerous small ponds are scattered throughout the muskeg.

Alpine Meadows Alpine meadows are dominated by cassiope and mixed forbs including mountain heather. These meadows are found on steep, well-drained rock outcrops at high elevation. Alpine lichen rock outcrops are found at high elevations above timberline. Plant cover does not exceed 50 percent. Species diversity is high and includes cassiope, clubmoss, and grass species.

Table 3-65 displays the approximate percent of area occupied by each nonforest plant series found in the North Revilla Project Area.

Table 3-65
Distribution of Nonforest Plant Communities
(By VCU and Percent)

VCU	Estuary Tidal Flats	Shrub Riparian	Muskeg	Rock Outcrop & Alpine Meadows	Water	Total Nonforest Land	Total Forested Land
732	4	1	*	8	2	15	85
733	1	*	1	5	3	10	90
735	0	0	0	1	1	2	98
736	0	0	0	1	1	2	98
737	0	4	*	5	2	11	89
738	*	1	1	2	1	5	95
739	1	1	*	4	1	7	93
740	*	*	*	1	*	1	99
Ave	*	1	*	3	2	6	94

SOURCE: Nightingale, 1992
Note: This information derived from Ketchikan Area GIS, CLU data layer
* = less than 1 percent

Silvicultural Systems

Silvicultural systems are named for the method of regeneration cutting by which the stand is replaced. These regeneration cuttings are selection (single tree and group), seed tree, shelterwood, and clearcut. They can be grouped into even-aged and uneven-aged systems, depending on the type of age structure that is created. Even-aged systems produce stands that consist of trees of the same or nearly the same age. A stand is considered even-aged if the range in tree ages normally does not exceed 20 percent of the rotation age–the age at which the stand is harvested; seed tree cutting, shelterwood cutting, and clearcutting will produce even-aged stands. Even-aged stands have a beginning and an end point in time. Uneven-aged systems create stands that include three or more distinctly different age classes, with no beginning or end point in time.

Even-aged Systems

Even-aged systems produce distinct successional stages and there are even-aged stands of various ages and sizes distributed throughout the managed forest. Therefore, even-aged forests have relatively low vertical diversity but have a high degree of horizontal diversity–the forest is a mosaic of forest and openings. The low vertical diversity is a result of the comparatively simple structure of the even-aged stand.

Clearcutting method This method involves the removal of the entire stand in one cutting, and reproduction is obtained artificially or by natural seeding from adjacent stands. In the narrowest sense, the cutting operation includes all standing woody

vegetation. A variant of this method includes felling only merchantable trees, and with careful harvest technique retaining the existing advance regeneration. This method is similar to large-scale disturbances such as wildfire or windstorms. The primary objective of this method is to re-establish an even-aged stand by removing the mature one. Decisions to clearcut are usually based on a number of factors such as insect epidemics, disease, fire, decadent stand conditions, desire to change species, desire to introduce genetically superior trees, or desire to meet the needs for regulating volume production through area control.

The clearcutting method with natural regeneration is the most commonly used system on the Ketchikan Administrative Area. The system works well, but natural regeneration is usually too abundant. The reproduction is derived partly from wind-dispersed seed and partly from advance reproduction that survived the logging operation.

Silvicultural advantages of the clearcutting method can be listed as follows: (1) it permits longer cable yarding distances than would be practical in partial cutting, permitting wider road spacing, reduced road costs, and less soil disturbance caused by road construction; (2) exposure to the sun raises soil temperatures, which speeds decomposition of the organic forest floor, thereby improving the productivity of the forest site; (3) clearcutting favors regeneration of Sitka spruce by destroying advance hemlock regeneration (reduces competitive advantage of the hemlock) and disturbing the forest floor, which creates seed beds that are more favorable for post-logging reproduction of spruce; (4) it eliminates residual overstory trees infected with dwarf mistletoe, which prevents infection of western hemlock in the new stand; (5) it eliminates the risk of blowdown in residual stands; (6) there is no logging damage to adjacent standing timber occurs; and (7) logging costs are lower than with other systems.

Silvicultural disadvantages of clearcutting are: (1) seedling distribution is uneven and parts of an area may become understocked or overstocked; (2) species control is poor; (3) the chance of blowdown along cutting boundaries is increased, but can be reduced through proper design of cutting units; (4) it tends to reduce protection against erosion, landslides, and rapid runoff of water; (5) clearcutting is esthetically the least desirable method, because of the heavily altered appearance of recently harvested areas; and (6) unmerchantable trees may have to be cut.

Currently the Project Area contains 12,206 acres of seedlings and saplings. Seedlings and saplings are trees less than or equal to 4.9 inches in diameter at breast height (dbh). There are 5,074 acres of poletimber and young sawtimber (5 inches to 9 inches dbh) sized stands. All of these sites were harvested using the clearcut silvicultural method.

Seed-tree method This method involves the removal of an old stand in one harvest entry, except for a small number of trees left singly, in small groups, or narrow strips, as a source of seed for natural regeneration. This method mimics a large-scale disturbance such as severe windthrow, which leaves a few mature trees per acre to serve as a seed source.

Silvicultural advantages of the seed-tree method are: (1) better distribution of seed occurs as compared with clearcutting; (2) better species composition than with clearcutting; (3) it can regenerate extensive areas of timber in areas too large to be seeded naturally from adjacent stands; (4) logging costs are low; (5) slightly better aesthetics than clearcutting; and (6) seed trees add some vertical diversity

Silvicultural disadvantages of the seed-tree method are: (1) it is limited to windfirm trees and it is not feasible where seedtrees will be blown over by wind; (2) control of spacing and the timing of the new crop is difficult; (3) it is costly to harvest seed trees, and damage occurs to regeneration; (4) soil protection is not much different than clearcutting; (5) it is commonly limited to light weight-seeded species; and (6) it is inappropriate when the seed trees have infestations of hemlock dwarf mistletoe (parasitic plant).

Shelterwood method This method involves the establishment of a new stand under the canopy of the old stand. Shelterwood cuttings mimic large-scale natural disturbances in which many trees are lost and the residual large trees may provide seed, and shelter the natural regeneration from extreme heat and cold. Hemlock and spruce lend themselves to shelterwood cutting because both species can become established under a forest canopy.

Silvicultural advantages of the shelterwood method are: (1) it allows ultimate control of site conditions for the regeneration of even-aged stands; (2) natural regeneration is usually more certain than the seedtree or clearcut method because there is a more abundant source of seed; (2) good soil protection is provided; (3) it is superior to all methods, except selection, with respect to protection of site and aesthetic considerations; (4) it can be applied to large areas; (5) it provides the best control over species composition, amount, and distribution; and (6) sheltering trees add some vertical diversity.

Silvicultural disadvantages of the shelterwood method are: (1) logging costs are increased because of the returns to the same area for smaller volumes and the care exercised to prevent excessive damage; (2) it requires a fairly windfirm species and it is not feasible where the sheltering trees will be blown over; (3) unavoidable damage to residual stand and reproduction occurs during logging, particularly on cable ground; (4) it is inappropriate when the sheltering trees have infestations of dwarf mistletoe; (5) several Oregon studies in hemlock-spruce stands suggest that overstocking of regeneration can be expected; (6) it is difficult to maintain spruce in the understory, because hemlock can tolerate more shade than spruce; and (7) growth rate of seedlings is slower under shade.

Uneven-aged Systems

Uneven-aged systems produce stands of high structural diversity because of the intermingling of the different age classes. Regulation of the forest is based on development and maintenance of a range of tree diameters, with many trees in the smaller diameter classes and progressively fewer in the larger diameter classes. These forests have a high degree of vertical diversity but horizontal diversity will be low. The system produces large blocks of continuous forest cover dominated by relatively mature trees; there is a gradual reduction of shade intolerant trees and understory plants. This system has not been formally tested in the hemlock-spruce type of Southeast Alaska.

Regulation of even-aged management is based on the area and time required to grow trees to a merchantable size. Regulation of uneven-aged stands requires the establishment of: 1) maximum tree diameter, 2) residual stocking levels or volume required to maintain growth and yield, and 3) the desired structure which controls the diameter distribution.

Single-tree method Trees are removed individually at random, from a large area. This method simulates natural disturbances caused by the death of scattered trees. Regeneration occurs under the partial shade of larger trees, and seedlings must be able to grow in a shaded environment. Sitka spruce and western hemlock are adapted to grow in a shaded environment. Under the selection method, the stand always has some relatively old trees. Some of the cuttings may be intermediate in immature age classes; each tree is evaluated for its contribution to the desired characteristics of the stand.

Silvicultural advantages of the single tree selection are: (1) it is capable of maintaining an uneven-aged stand; (2) reproduction of tolerant species is easily obtained; (3) seedbed site protection is excellent with little or no exposure to insolation (exposure to sunlight) and wind; (4) stands can be readily adapted to changing market conditions; (5) it usually has the highest aesthetic rating.

Silvicultural disadvantages of the single tree selection method are: (1) highly skilled people are needed to practice it; (2) logging costs are much higher because of the small volume per acre, the frequent entries to each stand required, the complexity of the logging systems, and the care necessary to hold damage to an acceptable limit; (3) crop trees are scattered throughout the stand; (4) risk of wind damage within the stand increases with partial cutting; (5) a more extensive road system needs to be constructed and maintained to secure the same volume of timber as obtained by use of other systems; (6) it would not be suitable for hemlock stands infected with dwarf mistletoe; (7) frequent light entries can result in accelerated stand deterioration as the stand is opened up to wind, and damage can be done to boles and roots of residual trees from felling and yarding tall, large-diameter, defective trees; and (8) shade tolerant western hemlock would eventually replace spruce and cedar species within the stand.

Group Selection method Trees are harvested in small groups (usually less than about two acres). The openings created in the stand resemble miniature clearcuts and the uneven-aged stand is composed of a mosaic of even-aged groups; the small openings simulate small natural disturbances.

Silvicultural advantages of the group selection method are: (1) the regeneration in the small groups grows up under even-aged conditions and better stem form is obtained; (2) harvesting is more concentrated so logging costs are lower than single-tree; (3) harvesting in groups lowers damage to the residual stand; (4) it tends to increase diversity of plants and animals because of a temporary increase in shade intolerant plants in the small openings; (5) intermediate cuts may be made less frequently without sacrificing diameter class distribution although composition may be affected; (6) the small groups may be esthetically more acceptable to some people; and (7) the small openings would be more favorable for spruce and cedar regeneration.

Silvicultural disadvantages of the group selection method are the same as the single-tree method but to a lesser degree. The major limitations on its use are the operational difficulties in the steep, rugged topography found in the Project Area.

Criteria for the Selection of Harvest Cutting Method

Criteria for the selection of harvest cutting methods to be used on national forests in Alaska are provided in 36 CFR 219.27(b) and the Alaska Regional Guide (USFS, November, 1983). The selected method must meet all of the criteria, which are:

1. Capable of meeting special management and multiple use objectives (36 CFR: Criteria 1 and 6, Regional Guide: Standard 2);

2. Permit control of vegetation to establish desired species composition, density, and rates of growth (36 CFR: Criteria 4 and 6);

3. Promote a stand structure and species composition which minimizes risks from solar radiation, disease, and windthrow (36 CFR: Criterion 4, Regional Guide: Standard 2);

4. Use available and acceptable logging methods (36 CFR: Criterion 4, Regional Guide: Standard 2);

5. Assure that lands can be adequately restocked (36 CFR: Criterion 2);

6. Be practical and economical in terms of transportation, harvesting, preparation, and administration of timber sales (36 CFR: Criterion 7, Regional Guide: Standard 2); and

7. Not be selected solely on the basis of greatest dollar return or highest output of timber, and not permanently reduce site productivity or impair conservation of water and soil resources (36 CFR: Criteria 3 and 5).

In addition to the applicable laws and regulations, on June 4, 1992, the Chief of the Forest Service issued national direction on reduced use of clearcutting (Robertson 1992). Clearcutting would be limited to areas where it is essential to meet forest plan objectives and involve one or more of the following circumstances:

1. To establish, enhance, or maintain habitat for threatened, endangered, or sensitive species.

2. To enhance wildlife habitat or water yield values, or to provide for recreation, scenic vistas, utility lines, road corridors, facility sites, reservoirs, or similar developments.

3. To rehabilitate lands adversely impacted by events such as fires, windstorms, or insect or disease infestations.

4. To preclude or minimize the occurrence of potentially adverse impacts or insect or disease infestations, windthrow, logging damage, or other factors affecting forest health.

5. To provide for the establishment and growth of desired trees or vegetative species that are shade intolerant.

6. To rehabilitate poorly stocked stands due to past management practices or natural events.

7. To meet research needs.

Factors Influencing the Choice of Silvicultural Systems

The choice of silvicultural systems will depend on the silvical characteristics—that is, the reproductive habits and growth requirements—of the tree species, the operational environment (physical and biological setting), the management objectives that are to be achieved, and the operational feasibility of all logging systems (e.g., highlead, skyline, tractor, helicopter, etc.).

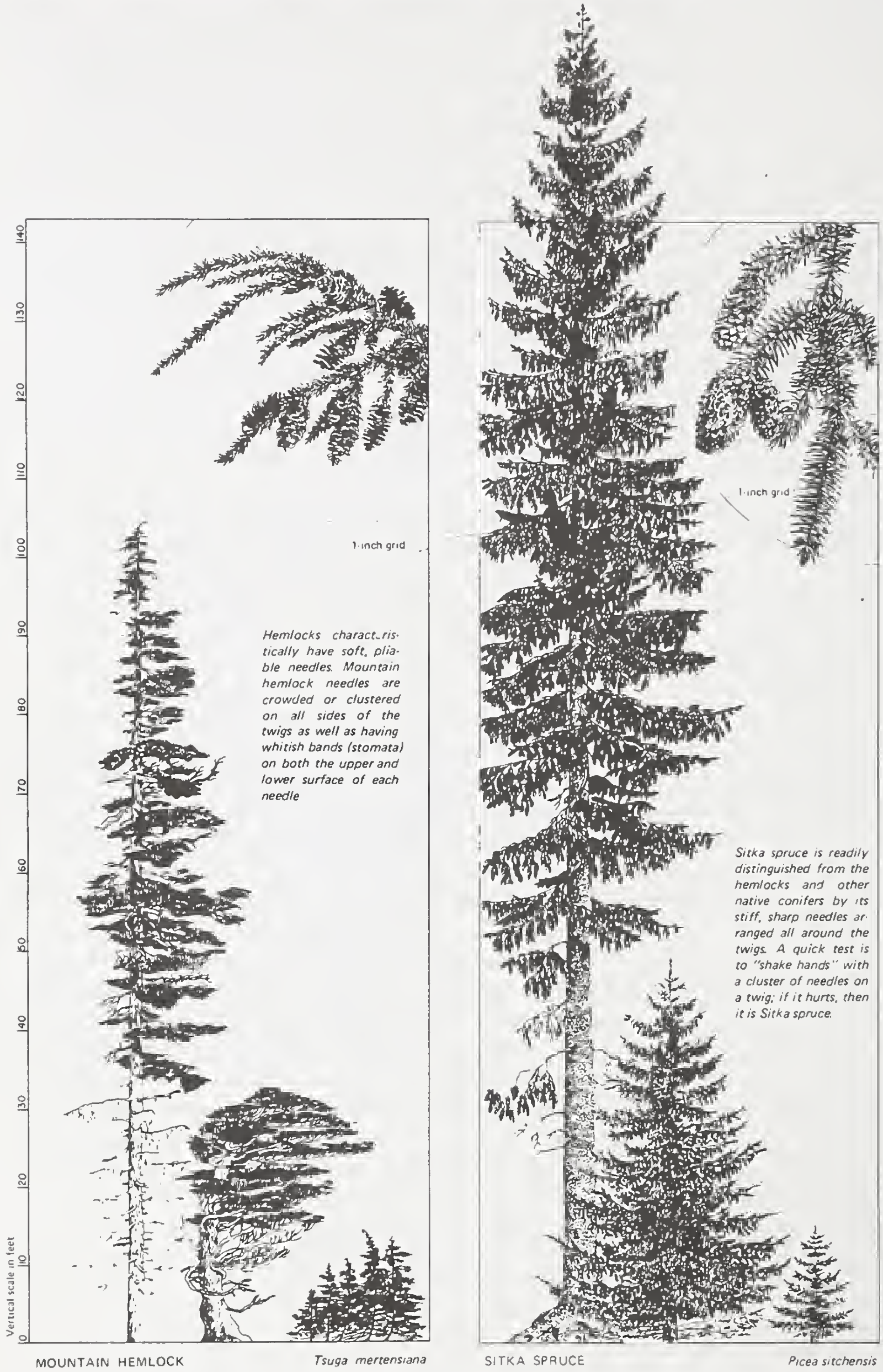
Silvical Characteristics - Commercial Species

Sitka spruce (*Picea sitchensis*) is the largest and one of the most valuable trees—both biologically and economically. This species is classified as intermediate in tolerance ("tolerance" is the ability to grow and prosper in the understory; light, moisture, or other environmental variables may be the limiting factor) and demands more light than its associate western hemlock (Harris and Farr, 1974). Sitka spruce is a prolific seed producer. It produces small seed that can be carried long distances. Sitka spruce seed will germinate on almost any kind of seedbed if moisture is abundant; consequently, natural regeneration can be obtained through various reproduction methods. Establishment is best on mineral soil with organic matter and with side shade and overhead light. Spruce has an advantage over hemlock on bare soil. The percentage of spruce reproduction often can be increased by clearcutting and exposing more mineral soil during the logging operation (Fowells, 1965). The rooting characteristics of Sitka spruce show great variability, but in Southeast Alaska the species tends to be shallow rooted; consequently, the species is vulnerable to compaction and blowdown. The bark is relatively thin, which makes it susceptible to logging injury and subsequent decay. Blowdown is the most serious damaging agent to Sitka spruce.

Western hemlock (*Tsuga heterophylla* (Raf.) Sarg.) is also a major component of the Tongass National Forest. Western hemlock is classified as very tolerant and dominates the reproduction of the old-growth forests (Fowell, 1965), which makes it an ideal species for management that includes partial cutting. Other associated conifers include western redcedar, Alaska yellowcedar, shore pine, lodgepole pine, Pacific silver fir, subalpine fir, and mountain hemlock. Western hemlock is a prolific seed producer. It produces seed almost every year, with heavy crops every five to eight years; the seed is small and can be carried long distances in strong winds. The species can thrive on a wide variety of seedbeds; consequently, natural reproduction can be obtained through various reproduction methods from single tree to clearcutting. Most stands contain advanced regeneration and through careful logging are often adequately stocked or overstocked. Hemlock does not develop a taproot and is a shallow rooted species; the species is susceptible to windthrow. Most of the roots, particularly the fine roots, are near the surface, and are susceptible to damage from compaction. Like spruce, this species also has thin bark and is susceptible to logging injury and subsequent decay. Hemlock dwarf mistletoe is an important disease and is usually best controlled by clearcutting.

Figure 3-16 illustrates characteristics of the mountain hemlock and Sitka spruce.

Figure 3-16
Characteristics of the mountain hemlock and Sitka spruce



Western Redcedar (*Thuja plicata Donn*) is an important tree species both economically and from a cultural perspective as well. Southeast Alaska Natives use this species for totem poles, clan houses, canoes, etc. because of its straight grain, size, lightweight and workable texture. The stringy bark was used for making mats, baskets and ropes. Western redcedar is commonly found in association with Alaska yellowcedar, western hemlock, lodgepole pine and Sitka spruce.

Western redcedar is less tolerant than western hemlock and Sitka spruce. Western redcedar is a prodigious seed producer, but because of the small surface area of the seed wing, the seed does not travel far from the source. Although the germination percentage is often quite good, the seedling mortality rates are usually quite high, particularly when exposed to full light. Western redcedar is near the northern edge of its range in the Project Area and is typically found on poorly drained organic soils in combination with Alaska yellowcedar, lodgepole pine, western hemlock and Sitka spruce. The best growth is achieved on better sites, where it forms a minor component of the stand with hemlock and spruce dominating. The best regeneration occurs on sites that have exposed mineral soil and full light. Like most cedars the tree is long lived and highly resistant to insect and disease attacks. The shallow water table on most organic soils makes western redcedar susceptible to windthrow. It is considered less windfirm than either spruce or hemlock and is used only as a last resort for either tailholds or guyline anchors.

Yellowcedar (*Chamaecyparis nootkatensis* (D. Don) Spach) is a minor but valuable commercial tree species found within the Project Area. At lower elevations it is commonly found on poorly drained organic soils in association with western redcedar, western hemlock, lodgepole pine and Sitka spruce. At elevations above 1,000 to 1,500 feet western redcedar is no longer a stand component and mountain hemlock replaces western hemlock. At elevations above 1,200 to 1,500 feet Alaska yellowcedar may be of only firewood quality. Good cone crops are irregular, occurring only one out of every four to seven years. The seed is heavy and will disperse 132 to 264 feet (2 to 4 chains). Alaska yellowcedar is classified as an intolerant species like western redcedar, and as such it is less shade tolerant than hemlock or spruce. Alaska yellowcedar is especially susceptible to winter drying where warm, sunny weather in combination with frozen soils causes top kill. Warm weather in the winter of 1956 resulted in extensive top kill that is still evident today. Yellowcedar decline is another problem (possibly the same as winter drying) that is resulting in dead tops and mortality. The upper third of the crown is the most productive for cone production and seed viability. The harvesting of old-growth cedar forests through large clearcuts has resulted in regeneration to other species. Whether this is due to the periodicity of the seed crops, the heavy seed with limited dispersal distance, cedar decline or some other cause is not known. Artificial regeneration or some form of partial cutting may be needed to ensure the continued presence of yellowcedar. Alaska yellowcedar is not particularly windfirm, but trees with dead tops provide much less resistance to the wind and may be quite windfirm.

Figure 3-17.
Characterisitics of the Western Redcedar and Alaska Yellowcedar.

Silvical Characteristics - Noncommercial Species

Pacific Yew (*Taxus brevifolia nutt.*) is a small tree or shrub that has never been found as far north as the Project Area but scattered trees have been located on the southern portion of Revilla Island (T. Demeo, USDA FS, Ketchikan Area Ecologist, personal communication, 1992). Pacific yew is at the very northernmost portion of its range. It is typically found within 500 feet of salt water as it depends upon the warm maritime climate to exist at this latitude. The bark from Pacific yew is high in taxol, which has been shown to have medicinal value for the treatment of cancer. The bark from Pacific yew trees located across the country is currently being tested for its taxol content. Cancer treatments are currently using taxol on an experimental basis. Due to the scattered nature of Pacific yew trees it is envisioned that plantations will be developed from the seeds of trees that have the highest taxol content in order for the medicine to be affordable. Pharmaceutical companies are currently attempting to develop a synthetic version of taxol.

Alder (*Alnus species*), both red and Sitka alder are found throughout the Project Area. Sitka alder tends to be shrublike in form with multiple stems and rarely exceeds 30 feet in height. In contrast, red alder usually has a single well defined stem and can reach heights of up to 50 feet in the Project Area. Alder is commonly found along beaches and streams, and on avalanche tracks and landslide chutes. Alders are also common on roadsides, landings, and wherever soil has been highly disturbed. Alder is a primary succession species (one of the first to recolonize highly disturbed sites) and is usually shaded out 40 to 50 years after first being overtopped by Sitka spruce. Red alder is rarely found above 1,000 feet in elevation, but Sitka alder may grow above 2,500 feet in the Project Area. Alder seed is extremely light and can be spread great distances by the wind. A mineral soil seedbed is required and both species of alder are extremely shade intolerant. During its maximum growing period, alder can achieve 5 feet of height per year. Both species have the ability to fix nitrogen from the the air. Because of this ability to fix nitrogen and from abundant leaf fall which adds needed humus, alder is important for stabilizing or improving disturbed forest soils. Red alder is used for smoking fish and for carving, but neither species is used commercially.

Operational Environment

Climate. The forest has a maritime climate with abundant moisture throughout the year and has relatively mild winter temperatures and cool summers. Lack of a pronounced drought is probably the most important factor in affecting vegetation. The combination of warm water from the Japanese currents and prevailing westerly onshore winds result in cool, humid conditions throughout the Project Area. The weather patterns of Southeast Alaska develop strong wind patterns and winter storms tend to be very intense. Gale force winds may occur during any month; however the strongest winds are most likely to occur in fall and winter months. The strong winds are usually accompanied by rainfall, and saturated soils that contribute to blowdown.

Table 3-66 displays the number of days, by month, when gale force winds occurred between 1953 and 1978. Gale force winds refers to a specific range of wind speeds using the Beaufort Scale, a descriptive method of defining windspeed devised by Sir Francis Beaufort in 1805 and still used today.

Table 3-66

Number of days, by month, with winds over 30 miles per hour, National Oceanographic and Atmospheric Administration (NOAA) meteorological station at Annette Island, Alaska, 1953-78

		Miles	per	Hour			Total
Month	31-35	36-40	41-45	46-50	51-55	56-60	Days
July	3						3
August	5	4					9
September	11	7	3		1		22
October	67	45	13	4	3		132
November	58	41	5	8	1		113
December	64	39	9	9	2	3	126
January	70	29	5	6	2	2	114
February	60	31	2	8			101
March	25	9	8	4			46
April	32	9	7	2			50
May	8	5	2				15
June	11	1	1				13
Total	414	220	55	41	9	5	744

SOURCE: Wind in the Forests of Southeast Alaska and Guides for Reducing Damage, A.S. Harris, PNW-GTR-244.

Over 80 percent of the gale force winds reported between the years 1953 and 1978 were from the south or southeast. Gale force winds occur during every month of the year and come from all directions. However, the vast majority of gale force winds come out of the southeast and occur during the fall and winter months when heavy rains have saturated the soils.

The management implications are: (1) moisture is not a limiting factor in tree regeneration; (2) wildfire is not a major problem; (3) high winds can cause heavy losses of timber by windthrow; (4) the relative risk of windthrow determines the range of silvicultural options available to meet the management objectives for a given site; and (5) the strong fall winds favor natural regeneration.

The rooting habits of western hemlock and Sitka spruce make these species susceptible to windthrow; both species are shallow rooted and depend on mutual support for wind resistance. Western hemlock does not develop a tap root. In addition, both species have thin bark, which makes them susceptible to logging damage to the tree bole and subsequent wood decay. Trees with stem or root rots are more susceptible to damage from the wind. Wind is a major disturbance factor in Southeast Alaska, altering the structure of the forest. Scattered windthrow of large overmature trees is a prime cause of mortality and it creates small openings in which the advance growth in the understory may develop (group selection would mimic this effect). Spruce is able to maintain itself as a stand component because of these small openings created by windthrow. Stands covering many acres can also be blown down, and many existing young-growth stands originated following the blowdown of the previous stand. The

traits of windfirm stands and stands susceptible to damage by wind are documented in Table 3-67.

Table 3-67
Traits of Windfirm Stands and Traits of Stands Susceptible to Windthrow

Trait	Windfirm Stands	Susceptible Stands
Age	Young	Old
Age Structure	Even-aged	Uneven-aged
Defect	Little Defect	Large amounts of defect
Height	Short	Tall
Stocking	Open stocking on less productive sites, muskeg or scrub stands	Dense Stocking on Productive Sites
Species Composition	Have a high percentage of cedar and hardwoods	Predominately spruce and hemlock
History	Intact with little evidence of recent openings	Previously damaged by blow-down
		Even-aged pole or young sawtimber opened by thinning or partial cutting.

SOURCE: Wind in the Forests of Southeast Alaska and Guides for Reducing Damage, A.S. Harris, PNW-GTR-244.

Topography. Topographic features also influence the probability of windthrow occurring; the following features may result in decreased windfirmness:

— Westerly or easterly aspects where storm winds are accelerated around ridges;
— Southerly aspects exposed to onshore winds;
— Sideslopes or flats parallel to water channels oriented in a general northwest-southeast direction, especially along the west side of channels—flats and valley bottoms at heads of inlets or bays exposed to southerly winds;
— Small islands, promontories, or slopes at constrictions of channels with open water to windward;
— Low ridges or upper leeward slopes.

Topography also influences the choice of logging methods and silvicultural methods. Historically, most yarding has been downhill because roads are usually located in valley bottoms to avoid the unstable soils on the steep slopes. Cable logging downhill in partial cuts is especially difficult because of inadequate deflection for full suspension

and lack of large enough tree root systems for adequate tailholds. Spruce and hemlock are prone to logging damage because of their thin bark and the risk of damage to residual trees is extremely high when attempting to remove trees, particularly on steep slopes using cable logging methods. Stands typically consist of large old trees with significant defect. These stands require large yarders to remove the logs. To control residual stand damage the logging plan must incorporate and the logger must conduct operations recognizing the following: (1) eliminate cross-slope yarding where dragging of logs is involved; (2) during lateral yarding the skyline must be positioned so that the entire log turn will be suspended above the ground when the logs enter the skyline corridor; (3) yard with the skyline positioned high above the ground to reduce skyline corridor width (Lateral excursion); (4) log turns must fly free of the ground in downhill yarding; and (5) skyline setting size must be restricted to control the clearcut effect from fan-shaped settings. The inability to meet all of these conditions on most areas generally makes cable logging partial cuts impractical. Other, more costly options, such as helicopters would have to be used.

Rationale for Selection of Harvest Cutting Methods

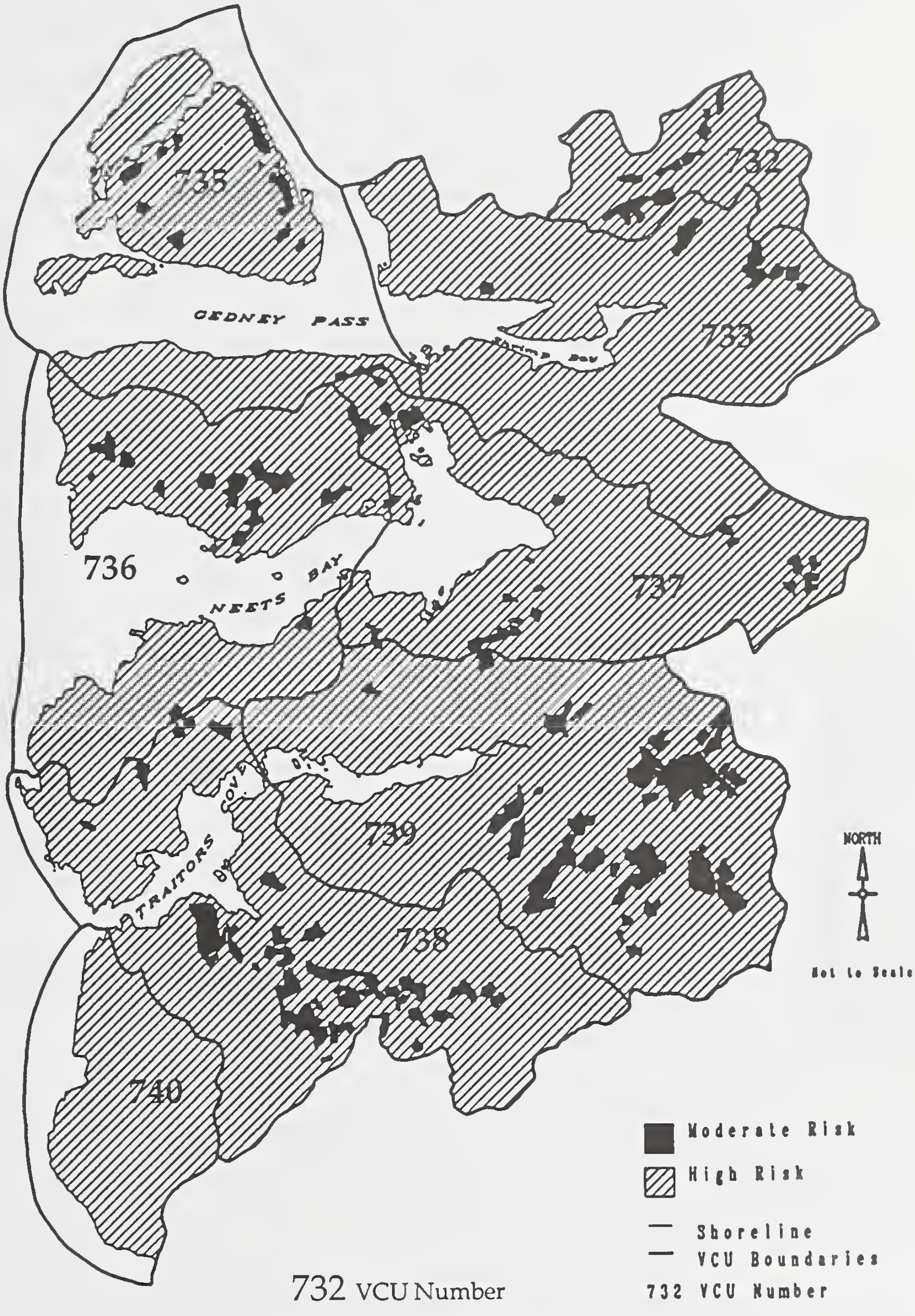
Both even-aged and uneven-aged harvest cutting methods are available for selection within the suitable productive forest lands. Factors other than the silvicultural or ecological limitations of the species weigh heavily in the choice between uneven and even-aged management and among the several silvicultural systems that can be used to create even-age stands. These include: economic considerations, other resource values, terrain considerations with its limitations on logging systems, and other operational environmental considerations such as the presence or absence of dwarf mistletoe, susceptibility to windthrow, and susceptibility to logging damage.

The first step in the selection of an appropriate silvicultural system for an individual site is the diagnosis or range of acceptable treatments including a deferred (no action, Alternative 1) entry. An acceptable treatment is one that is feasible and has a reasonable expectation of achieving sound silvicultural objectives. Silvicultural objectives typically include species composition, stand condition class, growth rate, density, insect and disease control, and stand development over time.

The next step is to use the Forest Plan, management concerns, and public issues to determine the objectives for the site, then select the silvicultural system that best meets the objectives. In order to meet the issues and concerns reflected in the various alternatives, one or more silvicultural systems may be selected for the same site depending upon the alternative.

In Southeast Alaska the range in silvicultural options is limited by numerous factors, but the most dominant is the risk of windthrow. Areas of high windthrow risk offer the option to defer entry or to clearcut. Other forms of regeneration harvest have little or no probability of success where long-term timber production is at least one of the objectives for the site. The one exception to the above statement is where cedar forms a significant component of the stand structure. Because of the extensive top kill caused by cedar decline, the tops of these trees pose little resistance to the wind and are therefore relatively windfirm. This is especially true at higher elevations where the soils are frozen rather than saturated during the winter months when the majority of gale force winds occur (see Table 3-66). Figure 3-18 displays the areas of high windthrow risk.

Figure 3-18
Windthrow Risk Areas



The most dominant factor affecting silvicultural options is the risk of windthrow. There are no areas of low windthrow risk in the Project Area.

Areas of moderate to low windthrow risk have a full range of silvicultural options available. Clearcutting is generally selected for these areas for the following reasons:

1. It is the most effective means of controlling dwarf mistletoe. The removal of infected trees interrupts the life cycle of dwarf mistletoe and reduces the chance for infestation of the future stand. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

2. It eliminates the risk of blowdown in residual stands. The potential for windthrow increases along cutting boundaries but can be reduced through proper design of cutting units. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

3. It eliminates the risk of stand damage to the residual stand. The spruce-hemlock stands are composed of large trees and require large pieces of logging equipment which can cause significant damage to the residual stand. Spruce and hemlock tend to be shallow rooted and therefore susceptible to damage from ground based systems; clearcutting reduces these risks. (36 CFR: Criterion 4, Regional Guide: Standard 2, Chief's Policy Letter: Criterion 4)

4. It favors spruce and cedar. The logging operation will destroy some of the advance hemlock regeneration and thus take away its initial advantage. The increased sunlight also favors the spruce. (36 CFR: Criteria 4 and 6, Chief's Policy Letter: Criterion 5)

Felling and yarding large trees often damages the remaining stand.

5. It can improve productivity. The cold air temperature and soil temperature do not favor decomposition of the organic forest floor. Exposing the site by clearcutting raises temperatures, which speeds the decomposition of raw humus and recycling of nutrients, particularly nitrogen. (36 CFR: Criterion 5, Chief's Policy Letter: Criterion 5)

6. It requires less road development. Less road construction is needed to remove a given amount of timber. Clearcuts favor longer spans which also allows for increased spacing between roads. (36 CFR: Criterion 5)

7. It is less costly. Fixed costs are spread over large volumes per acre and logging and road building is more concentrated. (36 CFR: Criterion 3 and 5, Regional Guide: Standard 2)

8. Natural regeneration is generally adequate. Experience with clearcutting since the 1950's has shown that, except for certain situations, attaining natural regeneration is not a serious problem in the North Revilla Project Area. Natural regeneration is abundant and generally averages 3,000 to 5,000 stems per acre ten years after harvest. Competition among seedlings for growing space and nutrients results in reduced growth rates at about age 15 to 20. Stocking control is intended to increase the rate of diameter growth of the remaining trees: tree size has a significant impact on log values, improves crown ratios, favor commercially valuable trees (spruce), favors species (forage) or age classes which are most valuable for wildlife, windfirmness may be increased with early thinnings, or achieve other mutiple-use objectives. (36 CFR: Critirion 2, Chiefs Policy Letter: Criterion 4 & 5)

Those Land Use Designations that contain selection or group selection harvest systems are lands that will be managed primarily for maintenance and enhancement of

resource values other than timber. Generally, any management of the timber resource on these lands will be for stand maintenance purposes only and will approach an uneven-aged silvicultural system. Production of high current or future timber yields is not a consideration. This prescription is primarily applied within stream riparian area (RP) boundaries.

Stand maintenance is not, strictly, a silvicultural system. Under this management regime or concept, individual trees or small groups of trees are removed if conditions indicate a disease or pest threat to the stand, imminent mortality, severe decline in growth, or trees in cable corridors. Stand maintenance, while a form of uneven-aged management, is different than the selection system (group or individual-tree) of management. Selection implies strict stocking control and a high intensity of management to maintain a predetermined ratio of tree ages and diameter classes in every stand. The intent is to manage the timber stands on these lands in order to maintain or bring them to the best condition possible until actual selection silviculture becomes feasible on these lands, until even-aged management can be made environmentally acceptable, or the lands are classified as unsuitable.

In addition to stand maintenance prescriptions, the other form of partial cutting that is being proposed in the North Revilla project is called a shelterwood harvest. Technically this is referred to as the seed cut in a two-step shelterwood. The purpose of the seed cut is to provide seed and shelter to promote a new crop of trees. The seed cut is followed (usually 10 to 20 years later) by an overstory removal that removes the trees left as seed and shelter during the first entry. The purpose of this prescription is to respond to an issue raised during public scoping and an internal concern that following clearcutting, natural regeneration of yellowcedar is totally lacking. Alaska yellowcedar forms a significant portion of the following plant associations:

Western hemlock-yellowcedar	- all associations
Mixed conifer	- all associations
Mountain hemlock-yellowcedar	- all associations.

The yellowcedar sites will regenerate naturally if clearcut, but the species composition is primarily western hemlock, mountain hemlock, Sitka spruce or western redcedar depending upon the elevation. Yellowcedar will usually not be represented and must be planted to re-establish the species. Sites that are clearcut harvested using a helicopter, will require a helicopter to move planters and planting stock to and from the unit. Helicopter costs to support planting activities can vary significantly depending upon the number of acres available to spread fixed costs over. Costs typically range from $700 to $1,200 per acre. The quality or grade of yellowcedar declines with increasing elevation. At lower elevations sawlog quality cedar is of the highest value while at higher elevations yellowcedar is primarily utility grade. Helicopter logging of utility grade yellowcedar followed by expensive artificial regeneration efforts makes it less expensive to retain the yellowcedar on high elevation, helicopter logging sites.

Table 3-68 displays the approximate acreage of identified partial removal opportunities for this project by VCU and alternative. The only form of partial cutting being attempted is called a shelterwood harvest in which the yellowcedar trees below a specified diameter will be retained on the site to provide seed and shelter for a future crop of trees. Alternative 1, the no-action alternative, proposes no harvest activities and is not displayed. Clearcutting is the only silvicultural system applied in Alternative 3 which attempts to maximize timber sale economics. Refer to Appendix

H, Silvicultural Diagnosis and Appendix K, Unit Design Cards, for a specific description of the silvicultural system recommended for each harvest unit.

Table 3-68

Acreage of Partial Tree (Shelterwood) Removal Opportunities Identified for the North Revilla Project by VCU and Alternative

	Alternative				
VCU	2	3	4	5	6
732	47	0	0	47	0
733	27	0	27	0	0
735	0	0	30	0	30
736	120	0	120	0	120
737	20	0	0	20	0
738	27	0	27	0	0
739	54	0	0	76	72
740	0	0	0	0	0
Total	295	0	204	143	222

SOURCE: Nightingale, Somrak (7/1993)
Note: This information derived from Ketchikan Area GIS, North Revilla Silvicuture Coverage.

Silvicultural systems other than clearcutting have not been applied on a large-scale basis in Southeast Alaska. The anticipated results are based primarily on research and experience from other parts of the country. Because of the experimental nature of these proposed harvest systems, each unit is considered to be a clearcut for the purposes of analyzing the direct effects on the visual and wildlife resources.

Size of Harvest Units

The National Forest Management Act of 1976 (NFMA) specifies a limit on the size of forest opening which may be created, based on the forest type. For the western hemlock/Sitka spruce forest type associated with Southeast Alaska, this maximum opening size is 100 acres. The NFMA provides leeway for extending this opening size to 150 acres under certain conditions (e.g., timber economics, regeneration requirements, wildlife or fisheries habitat needs, transportation or harvest system requirements, etc.) and for exceeding 200 acres under extreme circumstances (major insect and disease outbreak, fire, windthrow or other form of catastrophic damage).

Each of the action alternatives proposes harvest units which exceed 100 acres, but all are under 150 acres. Table 3-69 summarizes the number of units proposed by each alternative which exceed 100 acres, along with the range of unit size. Since Alternative 1 does not propose any timber harvest at this time and no acres would be cut, it is not displayed.

Table 3-69
Number of Units Exceeding 100 Acres & Range of Harvest Unit Size

Alt.	Total # of Units	Number Exceeding 100 Acres	Range Exceeding NFMA Size Requirements	Average Unit Acreage
2	205	8	103 to 145	40
3	124	9	103 to 128	46
4	123	7	101 to 146	48
5	188	4	102 to 132	34
6	137	7	103 to 128	48

SOURCE: Nightingale, Somrak (7/1993)
Note: This information derived from Ketchikan Area GIS, North Revilla LSPL Layer.

A detailed list of the individual units exceeding 100 acres, along with the reason for their inclusion, is shown in Appendix B.

Proposed Harvest by Site Class

Because some site classes are more productive than others, they are rated by a site index and are assigned a class of low, medium, or high. The site index is based on the expected height to which a tree will grow on that site within a given number of years (in this case, 50 years). On low sites, trees would be expected to grow between 45 and 56 feet in height in 50 years. On medium sites, trees would be expected to grow between 57 and 66 feet in height in 50 years and on high sites, trees would be expected to grow more than 77 feet high in 50 years. In general, more timber can be grown at less cost on a high site than on a medium or low site, and more timber can be grown at less cost on a medium site than on a low site (Davis 1966). However by mixing high, medium and low sites, average logging costs for low sites can be reduced and more land is available for timber management over the rotation.

Table 3-70 displays the acres of proposed harvest for each alternative by site class.

Table 3-70
Acres of Proposed Harvest by Site Class (Productivity)

Alt.	Low Acres	Low %	Medium Acres	Medium %	High Acres	High %	Total Acres	Total %
1	0	0	0	0	0	0	0	0
2	1,204	15	4,136	50	2,892	35	8,232	100
3	820	14	2,480	43	2,434	42	5,734	100
4	908	15	3,143	53	1,869	32	5,920	100
5	1,022	16	3,175	49	2,227	35	6,424	100
6	908	14	3,290	50	2,370	36	6,568	100

SOURCE: Nightingale, 1992
Note: This information derived from Ketchikan Area GIS, CLU data layer.

Alternative 2 proposes to bring the highest number of acres in medium and high site classes under management (7,028 acres or 85 percent of the acres proposed for harvest). Alternative 6 proposes to bring the second highest number of acres in medium and high site classes under management (5,660 acres, or 86 percent of the acres proposed for harvest), followed by Alternative 5 (5,042 acres or 84 percent of the acres proposed for harvest), Alternative 4 (5,012 acres or 85 percent of the acres proposed for harvest), and Alternative 3 (4,914 acres or 86 percent of the acres proposed for harvest). Alternative 1 proposes no timber harvest at this time and therefore does not provide an opportunity to bring medium and high sites under management.

Indirect and Cumulative Effects

Regeneration

All of the areas proposed for timber harvest will be restocked within 5 years as required under the National Forest Management Act of 1976 (NFMA). A combination of natural regeneration and artificial regeneration (tree planting) in conjunction with site preparation will be utilized to restock harvested areas. Site preparation includes the use of prescribed fire to reduce the amount of fine fuels which impedes regeneration. Prescribed fire is proposed for use on mixed conifer sites where excessive fine fuels limits the number of plantable spots, increases hand planting costs and reduces the survival rates for the cedar species. Only those mixed conifer sites which contain a high percentage of cedar and are scheduled for planting (less than 1,200 feet in elevation, south or west aspects, and 35-70 percent slope) will be considered for prescribed burning. The majority of plant associations in Southeast Alaska should not be treated with prescribed fire since the exposed duff layer dries out more rapidly. Native tree species do not send down tap roots (have shallow root systems) and are therefore susceptible to rapid drying of the duff layer during seasonal dry periods, until vegetative ground cover can be reestablished (usually 3 to 5 years after burning). This 3 to 5 year delay and the NFMA requirement to reforest a site within 5 years of harvest can result in areas having to be planted that would have regenerated naturally at less cost to the taxpayer.

Natural regeneration or planting result in the growth of new a new stand of trees.

Harvested sites must contain a minimum of 300 well dispersed trees per acre by the fifth year following harvest to be considered successfully regenerated. Survival (staked tree) surveys will be conducted on all planted sites the first and third full growing seasons after being planted. Regeneration (stocking) surveys must be conducted on all harvest units the third and fifth full growing season after yarding is complete. The third year survey is used to determine whether, if any, additional reforestation efforts are required. The fifth year survey is used primarily to certify that the regeneration process has been successful. Table 3-71 shows the acres of essential reforestation treatments to be performed by alternative. It should be recognized that areas requiring artificial regeneration cannot be accurately identified until after harvest when the third year stocking surveys indicate inadequate natural regeneration. Thus these acreage figures may change at the time planting would occur. Appendix I lists the specific essential reforestation treatments proposed by harvest unit by alternative.

Table 3-71
Anticipated Essential Reforestation Treatments (by alternative)

Alt.	Natural Regeneration Surveys 3 & 5 years	Plantation Stocking Surveys 1&3 years	Site Prep Prescribed Burning	Tree Planting Acres
1	0	0	0	0
2	7,876	356	154	356
3	5,239	495	160	495
4	5,576	344	139	344
5	5,944	480	142	480
6	6,115	453	125	453

SOURCE: Nightingale, 1992
Note: This information derived from Ketchikan Area GIS, North Revilla Silviculture Coverage.

Long-term Timber Productivity (Yield)

The effects of all action alternatives on long-term yield would be the conversion of unmanaged, overmature stand to managed, faster growing, early seral, even-aged stands. Overmature stands have lower forest floor temperatures than even-aged stands; thus reducing biological activity. Organic decomposition slows, and as a result, the supply of available nutrients is reduced. With decreased biological activity, less nitrogen is available for tree growth and nutritional status is lowered. While overmature stands growth and vigor remain nearly constant, they are at a level below that of even-aged stands (Harris et al. 1974). Table 3-72 displays the average structural characteristics of managed stands by site classification (low, medium, and high).

The magnitude of the effect of converting unmanaged, overmature stands to managed, even-age stands will vary depending upon the number of acres harvested in each site class. Alternative 2 converts the most acres to managed condition (8,232 acres), followed by Alternative 6 (6,568 acres), Alternative 5 (6,424 acres), Alternative 4 (5,920 acres), and Alternative 3 (5,734 acres). Alternative 1 proposes no timber harvest and will not convert any stands to a managed condition.

Table 3-72
Average Structural Characteristics of Managed Stands (by Site Classification)

Stands Age (years)	Height (feet)	DBH (inches)*	Volumn/Acre (board feet)**
Low Site			
5-20	26	1.4	0
20-50	56	4.9	1,900
50-80	82	8.5	14,100
80-100	96	10.8	25,500
100-120	107	12.8	37,100
120-160	122	16.4	56,800
Medium Site			
5-20	29	3.5	0
20-50	66	9.8	7,400
50-80	98	13.6	29,800
80-100	114	15.7	46,100
100-120	126	17.8	61,400
120-160	144	21.3	81,900
High Site			
5-20	31	4.0	100
20-50	77	11.0	13,900
50-80	111	15.2	43,400
80-100	127	17.5	62,400
100-120	139	20.1	78,000
120-160	157	24.1	100,300

Source: Forest Service, 1991
* Diameter at breast height; ** Net Sawlog

All stands proposed for harvest are overmature and well beyond the age of maximum average annual growth of the stand. They are representative of uneven-aged western hemlock stands that commonly take hundreds of years to develop under natural conditions (that is, unless they are changed by natural events such as windthrow or manipulated by intensive forest management practices).

The open conditions created by clearcutting allow both Sitka spruce and western hemlock to regenerate rapidly. Even-aged stands are generally comprised of 10 to 75 percent spruce depending on the soil type and age of the stand. On average, the volume of spruce in even-aged stands 75 to 100 years after harvest is about 50 percent (Taylor 1934) compared to 28 percent in existing overmature stands. With the use of precommercial thinning, an additional 10 percent increase in the spruce component is expected.

Although log quality in second-growth stands is expected to be lower than in existing overmature stands, even on sites that have been precommercially thinned, total yield per acre will be higher in second-growth stands. The lower quality will be reflected in the log grades, with second-growth timber stands having fewer top grade logs than existing overmature stands. In addition, second-growth stands will have less volume in the larger diameter classes. Nevertheless, total yield will be significantly greater in second-growth stands than in over-mature stands. The long-term result

of precommercial thinning is more useable wood fiber. Precommercial thinning also allows the option of reducing the economic rotation age. This is because merchantable size logs are produced at an earlier age if the site is thinned.

Most second-growth even-aged stands will exhibit less variation in tree diameter and height than the overmature stands they replace. At 100 years of age, average diameters for unmanaged second-growth stands will range from 13 inches on medium sites to 15 inches on high sites. With precommercial thinning, it is possible to produce average stand diameters that approximate old-growth averages. At age 100, diameters can range from 16 inches on medium sites to more than 18 inches on high sites (Forest Service 1990).

Precommercial Thinning

Regeneration of naturally disturbed or harvested areas may result in stocking levels of seedlings/saplings on many upland sites with an average of 4,000 stems per acre. Although these stands will eventually thin naturally, production of useable wood fiber would be hastened if stocking were less dense through the use of precommercial thinning (Harris and Farr 1974). Growth and yield models indicate that for every acre precommercially thinned, timber yield increases by 6.9 MBF on medium and 8.9 MBF on high sites, over a 100-year rotation. Precommercial thinning reduces the competition for sunlight, moisture and nutrients for what is often referred to as growing space. This additional growing space results in the understory plants and remaining conifers growing at accelerated rates for longer time periods than unthinned, second-growth stands. Precommercial thinning can also be used to change species composition and windfirmness of the stand. Where necessary, release (felling submerchantable whips infected with dwarf mistletoe) will occur at the same time as the precommercial thinning to prevent the re-infection of the new crop of trees. It should be recognized that precommercial thinning is performed approximately 15-20 years after harvest and is dependent upon site, stocking, and other resource needs. Table 3-73 shows the number of acres that have been identified for potential precommercial thinning in the future, by alternative.

Precommercial thinning prolongs understory vegetation and enhances growth rates on the remaining trees.

The Silviculture Diagnosis

Appendix H presents a detailed listing of the sites by alternative where precommercial thinning is proposed when the stand reaches 15 to 20 years old.

Table 3-73
Precommercial Thinning & Release Acres (by Alternative)

Alternative	Release	Potential Precommercial Thinning Sites 15-20 Years after Harvesting
1	0	0
2	457	3,567
3	304	2,868
4	335	2,487
5	358	2,594
6	358	2,946

SOURCE: Nightingale, 1992
Note: This information derived from Ketchikan Area GIS, North Revilla Silviculture Coverage (SGCUT).

In addition to the acres identified in Table 3-73 for future precommercial thinning, the following sites (existing second growth stands) would benefit from precommercial thinning at this time. If adequate Knutson-Vandenberg (KV) funds are available to perform sale area improvement work; the following precommercial thinning needs have been identified:

High Priority Wildlife Precommercial Thinning - 387 acres
Medium value Wildlife Precommercial Thinning - 1,823 acres
Timber Production Precommercial Thinning - 1,710 acres.

In general, high priority wildlife precommercial thinning sites are less than 800 feet in elevation and located on south or west facing aspects. Medium value wildlife sites are also on south and west facing aspects, but occur on elevations up to 1500 feet. Timber production precommercial thinning occurs on medium and high productivity sites not scheduled for fish and wildlife thinning. All sites would be 15 to 20 years old during the proposed operating period, plus 5 years for the time to perform KV work. This time period is estimated to be 1993 through 2001. A detailed listing and description of the sites proposed for KV precommercial thinning is listed in the Sale Area Improvement/KV Opportunities, Appendix I.

Second Growth Management for Other Resource Values

Fisheries Rehabilitation - Approximately 17 percent of the riparian management areas within the project area were harvested between 1954 and 1990. Most of this timber harvest occurred in the Margaret Creek and Neets Creek watersheds 25 to 35 years ago, before any significant stream protection measures were implemented. As a result, many Class I and Class II streams that would receive a stream buffer today, were harvested up to the bank.

Riparian management areas previously harvested for timber are now in various stages of secondary plant succession. Except where the ground was highly disturbed, the stand composition on the secondary successional riparian areas is similar to riparian vegetation prior to timber harvest, with Sitka spruce typically forming the canopy. On the more disturbed sites where mineral soil was exposed during timber harvest activities, the vegetation is often composed of early successional species, such as red alder and salmonberry.

Many studies have established the need for large woody debris (LWD) material in streams. It is an important component to bedload dynamics as well as providing structure, habitat, and as nutrient sources. Existing riparian stands of extremely dense conifers or alder, similar to those in Neets Creek for example, will require a long period of time (150–200 years) to develop large material for recruitment. Management of these existing riparian stands could produce the same size material for recruitment much sooner. On a high site index stand (most riparian sites are very productive), a precommercial thinning at age 15 (maintain growth rates and promote windfirmness), followed by a second precommercial thinning at age 40 to 50 (variable spaced thinning from below and a high thinning that would girdle rather than fell the trees) could produce 5–24 snags per acre over 15 inches in diameter (USDA Technical Bulletin No. 544). This would also promote the initial development of two storied stand. A third noncommercial entry at age 75, utilizing a combination of high and low thinning by girdling rather than felling) could create as many as 6 to 10 snags per acre over 24 inches in diameter. The objective of this type of treatment would be to promote a multi-storied canopy layer over time, promote habitat for snag dependent wildlife, and as the snags fall over, begin to provide LWD much sooner than would occur naturally. A site-specific silvicultural prescription that incorporates the concepts listed above could be prepared if funding is available for fisheries rehabilitation work.

Wildlife Management - The structure and composition of second-growth stands are dramatically different than that of old-growth. Second-growth management is not intended to mimic or replace the need for old growth (see Chapter 3, Biodiversity section). It is possible, though, to achieve commodity production objectives in a way that lessens the negative impacts upon certain wildlife habitat needs through the application of ecosystem management principles. However, in places likes Neets Creek, large drainage bottom clearcuts in the 1960's have created expansive second-growth stands. These are dense, single storied stands with little understory forage and few standing snags. The prevailing theory on second-growth management for wildlife, would say that these stands are too old to thin for forage enhancement (over 25 years of age). The IDT concurs with that assessment.

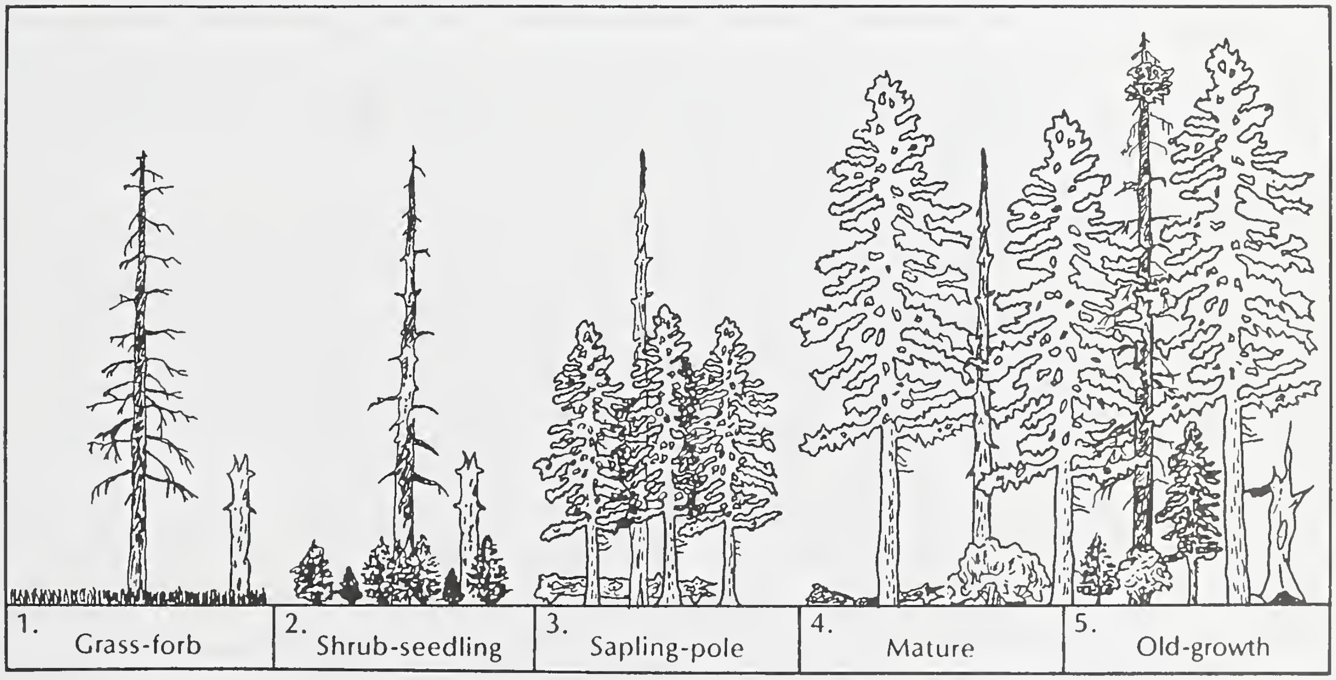
Second-growth stands that were once part of historic wildlife travel corridors or important winter habitat (low elevation, south aspect, productive site) such as those identified in the previous section would benefit from precommercial thinning. The key to this strategy is to extend the rotation (example 200 years) and not manage for short-term benefits at the beginning of the rotation, but to empahsize wildlife values over the last 100 years of the extended rotation. For example, a combination of low thinning and girdling could create snag habitat by age 50–60 years; subsequent girdling every 30–40 years would maintain snag habitat as well as allow for recruitment of forbs and shrubs back into the site much sooner than would occur naturally. The extended rotation would assure that these benefits accrue over a longer period of time.

A site-specific silvicultural prescription that incorporates these concepts would be prepared in coordination with a wildlife biologist prior to implementation, should funding be available. Due to the fact that most second-growth management

prescriptions to promote other resource values are somewhat experimental (very few examples of managed older second growth exist), the potential benefits were not used in modeling future wildlife/fisheries or other resource values.

Plant Community Successional Stages Including Old-growth

After reforestation, managed forests grow through several distinctive successional stages which generally are applicable to all units proposed for harvest under the action alternatives. Characteristics such as height, diameter, and productivity vary according to site class (discussed previously in this section). Different components dominate the stand at different stages, and the overall forest structure changes over time.



Managed forests progress through several distinctive successional stages.

Seedling/Sapling Stage The first 20 years following harvest is referred to as the seedling-sapling understory colonization stage. During the first 5 years of this stage the young stand receives maximum sunlight, resulting in the rapid establishment of a variety of shrubs, forbs, and grasses. There is little incidence of damage or mortality from disease or infestation at this stage. The changed structure of the young stand affects the structure of adjacent stands – windthrow potential increases with greater wind exposure and understory development accelerates due to increased sunlight into the newly developing stand.

In years 5 to 20, seedlings grow into a vigorous new forest of trees, averaging about 20 feet in height and 1 to 3 inches diameter at breast height (DBH). Understory production of woody-stemmed species is at its highest at this stage, especially in blueberry-dominated sites. Larger dead materials from the original stand begin to decompose, and the stand edge is stabilized – resulting in less windthrow to the adjacent stand. At the end of this successional stage, the stand can be considered for precommercial thinning, leaving a species composition of about 60 percent western hemlock, 40 percent Sitka spruce, and a small cedar component.

Table 3-74 tracks the cumulative acres in the seedling/sapling stage from the present condition, through implementation of each alternative, to the end of the long-term contract in 2004. These figures represent the current condition and the changes that occur over time as the stands grow from one stage to the next. Alternative 2 projects the highest number of acres in the seedling/sapling stage (18,936 acres), followed by Alternative 5 (17,519 acres), Alternative 4 (17,235 acres), Alternative 6 (17,026 acres), and Alternative 3 (16,120 acres). Alternative 1, the No Action alternative, projects the lowest number of acres in this successional stage.

Table 3-74
Direct and Indirect Effects in Acres on the Seedling/Sapling Stage (by VCU and Alternative)

VCU	Existing Condition (1993)	Alt. 1 1997	Alt. 1 2004	Alt. 2 1997	Alt. 2 2004	Alt. 3 1997	Alt. 3 2004	Alt. 4 1997	Alt. 4 2004	Alt. 5 1997	Alt. 5 2004	Alt. 6 1997	Alt. 6 2004
732	0	0	0	245	245	0	0	0	0	371	371	0	0
733	1,071	813	779	1,658	1,624	1,347	1,313	1,649	1,615	1,421	1,387	1,610	1,576
735	907	490	225	1,231	966	1,036	771	1,345	1,080	805	540	1,270	1,005
736	1,410	1,381	1,317	2,282	2,218	2,219	2,155	2,126	2,062	2,016	1,952	2,328	2,264
737	1,478	690	690	1,968	1,968	1,144	1,144	2,141	2,141	2,081	2,081	1,261	1,261
738	3,031	3,001	809	5,273	3,081	4,624	2,432	4,303	2,111	4,639	2,447	4,760	2,568
739	3,150	2,946	2,624	4,786	4,465	4,627	4,305	3,508	3,186	4,243	3,921	4,602	4,280
740	1,158	1,030	1,030	1,140	1,140	1,088	1,088	1,199	1,199	1,199	1,199	1,088	1,088
Total	12,206	10,351	7,474	18,583	15,706	16,085	13,208	16,271	13,394	16,775	13,898	16,919	14,042

SOURCE: Nightingale, 1992

Note: This information derived from the Ketchikan Area GIS database, TIMTYP data layer. Alternative 2 harvests the maximum amount of timber, while still meeting Forest Plan Standards & Guidelines. The 2004 values for Alternative 2 represent the projected indirect affects of timber harvesting through the life of the Long-term Sale Contract for all alternatives. The effects of time on the successional stages is important for estimating the effects on wildlife. Therefore the Alternative 2 2004 values were not repeated to avoid masking this information.

Future harvest through 2004 will add to the acreage in this stage. Alternative 2, which harvests the maximum amount of timber allowed under Forest Plan standards and guidelines, has been used to project the level of harvest through 2004. It is assumed that reduced levels of harvest as part of a current alternative will be harvested in a future entry. To do otherwise, would require a change in the land use allocation, which is beyond the scope of this document.

Pole/Young Sawtimber Stage The next successional stage occurs during years 20 to 50 following harvest and is referred to as the understory exclusion stage. It is characterized by accelerated tree growth (approximately one foot per year) and a rapidly closing tree crown canopy. At age 50, tree heights range from 48 to 72 feet and diameters range from 5 to 10 inches, depending on the site class. Tree crowns begin to grow closer together, causing the understory to change from a dense shrub, herb, and seedling-dominated structure to one of dense moss. Stands which have been precommercially thinned will have a two-layered canopy with western hemlock in the lower story. Canopy closure will occur more slowly in precommercially thinned sites. As any proposed harvest would probably not begin until 1994 and is expected to be completely offered by 1997, none of the units proposed for harvest at this time would grow into this successional stage by 2004. The only change that occurs is the growth of some of the existing harvest units into the understory exclusion stage.

In years 50 to 80, the stand remains closed. At age 80, tree heights range from 74 to 107 feet and diameters range from 8 to 13 inches, depending on site class. Little sunlight reaches the forest floor, and the understory continues to be dominated by moss. Tree diameter growth slows to about one inch every ten years, as competition between trees increases. It is not currently economically feasible to commercially thin

trees at this stage, but thinning would increase growth and diversity of the shrub layer, as well as increase diameter growth of the remaining trees.

Table 3-75 tracks the cumulative acres in the pole/young sawtimber stage from the present condition, through implementation of each alternative, to the end of the long-term contract in 2004. These figures represent the current condition and the changes that occur over time as the stands grow from one stage to the next.

Table 3-75
Direct and Indirect Effects in Acres on the Pole/Young Sawtimber Stage
(by VCU and Alternative)

VCU	Existing Condition (1993)	Alt. 1 1997	Alt. 1 2004	Alt. 2 1997	Alt. 2 2004	Alt. 3 1997	Alt. 3 2004	Alt. 4 1997	Alt. 4 2004	Alt. 5 1997	Alt. 5 2004	Alt. 6 1997	Alt. 6 2004
732	27	27	27	27	27	27	27	27	27	27	27	27	27
733	1,066	1,279	1,358	1,279	1,358	1,279	1,358	1,279	1,358	1,279	1,358	1,279	1,358
735	485	485	1,167	485	1,167	485	1,167	485	1,167	485	1,167	485	1,167
736	1,170	1,181	1,263	1,181	1,263	1,181	1,263	1,181	1,263	1,181	1,263	1,181	1,263
737	1,909	1,937	2,697	1,937	2,697	1,937	2,697	1,937	2,697	1,937	2,697	1,937	2,697
738	313	313	2,535	313	2,535	313	2,535	313	2,535	313	2,535	313	2,535
739	336	553	863	553	863	553	863	553	863	553	863	553	863
740	103	103	231	103	231	103	231	103	231	103	231	103	231
Total	5,409	7,264	10,142	7,264	10,142	7,264	10,142	7,264	10,142	7,264	10,142	7,264	10,142

SOURCE: Nightingale, 1992
Note: This information derived from the Ketchikan Area GIS database, TIMTYP data layer.

As the proposed harvest would probably not begin until 1994 and is expected to be completely offered by the year 1997, none of the acres proposed for harvest this entry would grow into this successional stage by 2004. Likewise none of the projected harvest through 2004 would have grown into this successional stage. The only change that occurs is the growth of some of the existing harvest units into the pole/young sawtimber stage. Thus each alternative shows the same number of acres in this successional stage after implementation and in 2004.


The old-growth stage has the highest degree of variation and most structurally diverse understory.

Mature Sawtimber Stage In years 80 to 100—the mature, even-aged forest and understory reinitiation stage—the stand becomes mature. At age 100, tree heights range from 88 to 123 feet and average stand diameters range from 10 to 15 inches, depending on site class. Some trees may die, while others become clearly dominant in size. Diameter growth remains at less than 1 inch every 10 years. Moss continues to dominate the understory, except in places where the canopy has opened and allowed sufficient light for herbaceous plants. These structural characteristics continue into the later stages of the stand (approximately 100 to 160 years) with continued slow growth and occasional openings in the canopy (Forest Service, 1989b).

Old-growth Stage The final successional stage for a forest is the old-growth stage, which would pertain to stands that are prescribed to be managed for old-growth conditions or stands that have been deferred for harvest. This stage is characterized

by a multi-storied stand with a large over mature overstory composed of live and dead trees and an understory of mostly shade-tolerant western hemlock. There would be a substantial component of downed large trees and occasional openings in the forest canopy. Patches of shrubs, tree saplings, and herbs alternate with patches of overmature timber, creating a complex, multi-layered mosaic. The stand declines in growth and has the highest degree of variation and most structurally diverse understory of any successional stage.

Table 3-76 presents the acres of old-growth that existed prior to the KPC Long-term Timber Contract, the acres that are projected to remain following implementation of each alternative, and the acres of old-growth expected to remain at the end of the contract period (2004).

Table 3-76
Projected Acres of Remaining Old-Growth Sawtimber (by VCU and Alternative)

	Existing Condition	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
VCU	(1993)	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004	1997	2004
732	2,668	2,668	2,423	2,423	2,423	2,668	2,423	2,668	2,423	2,297	2,297	2,668	2,423
733	10,201	10,201	9,356	9,356	9,356	9,667	9,356	9,365	9,356	9,593	9,356	9,404	9,356
735	6,247	6,247	5,506	5,506	5,506	5,701	5,506	5,392	5,392	5,932	5,506	5,467	5,467
736	7,208	7,208	6,307	6,307	6,307	6,370	6,307	6,463	6,307	6,573	6,307	6,261	6,261
737	6,238	6,238	4,960	4,960	4,960	5,784	4,960	4,936	4,754	4,847	4,847	5,667	4,960
738	8,762	8,762	6,490	6,490	6,490	7,139	6,490	7,460	6,490	7,124	6,490	7,003	6,490
739	12,206	12,206	10,366	10,366	10,366	10,525	10,366	11,644	10,366	10,909	10,366	10,550	10,366
740	3,397	3,397	3,287	3,287	3,287	3,339	3,287	3,228	3,228	3,228	3,228	3,339	3,287
Total	56,927	56,927	48,695	48,695	48,695	51,193	48,695	51,156	48,316	50,503	48,397	50,359	48,610
% of 1954 Acres	76	76	65	65	65	69	65	69	65	68	65	68	65

SOURCE: Nightingale, 1992
Note: This information derived from the Ketchikan Area GIS database, TIMTYP data layer.

The cumulative effects of harvesting old-growth will result in the conversion of large areas to a mosaic of second growth sites of differing age classes. By the year 2140 it is projected that 23,000 acres, or 31 percent of the original 74,541 acres of old-growth (commercial forest land) will remain in the Project Area, if Alternative P of the TLMP Draft Revision (1991a) is implemented.

At the end of the rotation in 2140, approximately 23,000 acres on 31 percent of the old-growth will remain intact.

Timber: Affected Environment

Forest Classification

The 109,520 acres of land within the North Revilla Project Area are defined by their ownership and vegetative cover. This land has been categorized as forest land, nonforest land, or other ownership.

Other Ownership

Other ownership refers to lands owned by private individuals, by the State of Alaska, or by Alaska Native corporations. For the purposes of this document, it also includes lands which have been selected but not conveyed to the State or to Native corporations (see Land Status section of this chapter). About one percent (approximately 880 acres) of the Project Area is encumbered, or may soon be in other ownership.

Nonforested means National Forest System land that is biologically unable to support a cover of predominantly timbered vegetation. This includes muskeg, rock out-croppings, talus slopes and water bodies among others. About five percent (approximately 5,900 acres) of the Project Area falls into this category.

Forested land refers to National Forest System land that consists largely of timbered vegetation and is further categorized as commercial forest land (CFL) or noncommercial forest land.

Noncommercial forest land doesn't support enough timber volume to meet the criteria for CFL. The Project Area forested land area contains about 26 percent (28,200 acres) of noncommercial forest land.

Commercial Forest Land (CFL) is capable of producing continuous crops of timber. The Forest Service has specified that each acre of commercial forest land must be capable of producing 20 cubic feet of tree growth annually or must contain at least 8,000 board feet (MBF) of net timber volume (USDA Forest Service 1977a). Old-growth and second-growth stands (younger, even-aged stands that grew after the previous stand was harvested or destroyed by agents such as wind, fire, or insects) may qualify as CFL. The North Revilla Project Area is composed of about 68 percent (74,540 acres) CFL.

Figure 3-21 displays the breakdown of the various Forest Land Classifications within the Project Area, Figure 3-20 identifies the components of the CFL, and Figure 3-21 identifies Commercial Forest Land and State Land Selections within the Project Area.

Figure 3-19
Forest Land Classifications

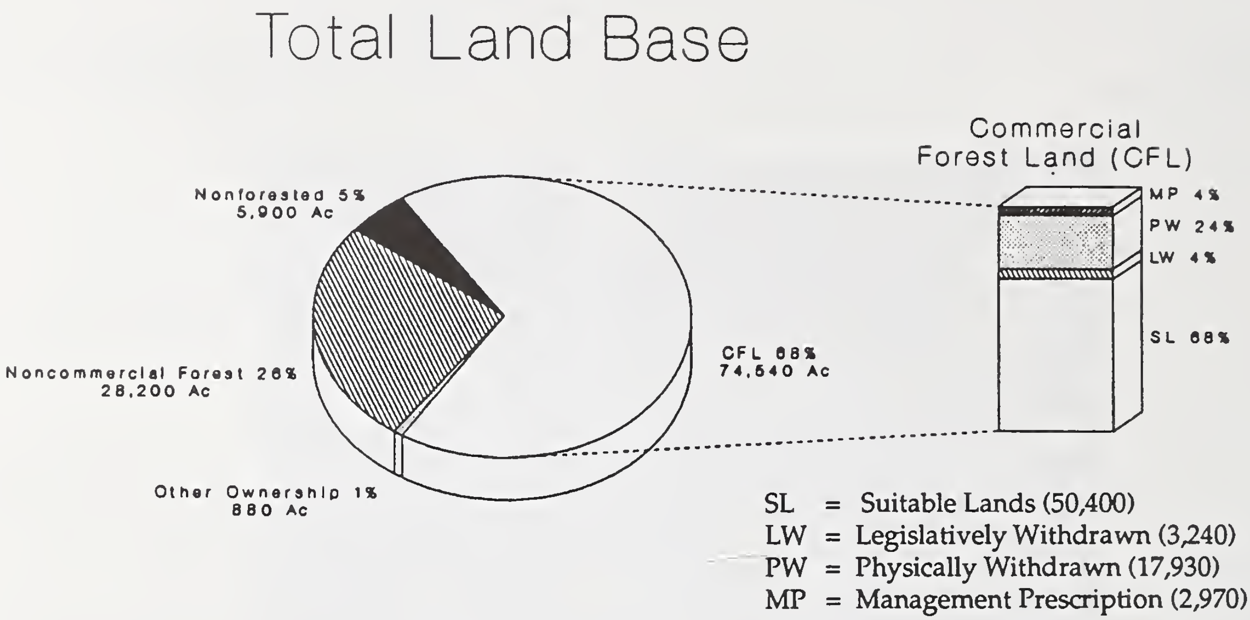


Figure 3-20
Components of Commercial Forest Land

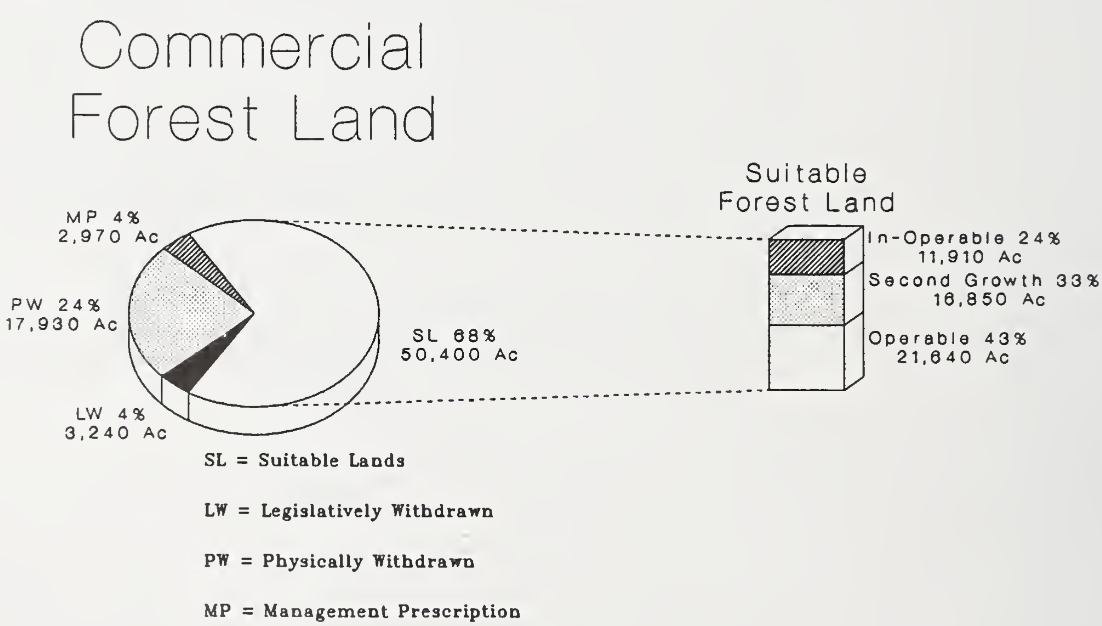


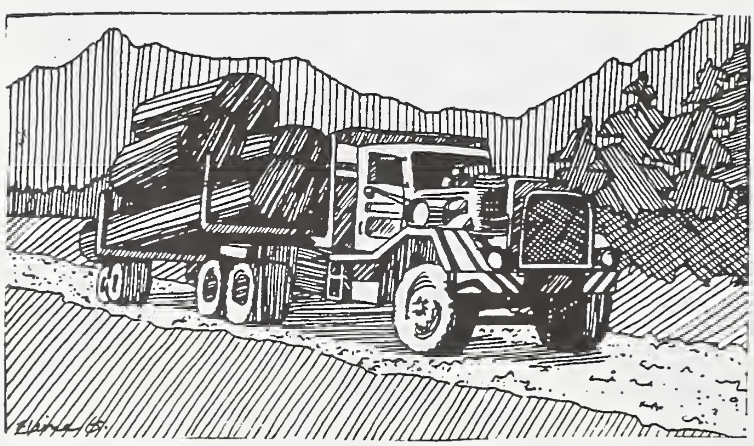
Figure 3-21
Commercial Forest Land within the Project Area

74,540 acres (68%) of the 109,520 acre Project area is CFL

Tentatively Suitable Forest Lands

CFL is further defined as to its suitability undergoing review as identified in Appendix A of TLMP (1979, as amended), TLMP Revision (1991a). To be considered Tentatively Suitable, the CFL must:

— be forested lands that have both the biological capability and availability to produce crops of industrial wood;
— not be developed for nonforest uses;
— be capable of harvest with available technology to ensure timber production without irreversible resource damage to soil productivity or watershed conditions;
— be capable of restocking within five years after final harvest;
— have adequate information available to project response to timber management practices;
— have not been withdrawn legislatively from a timber production classification.



Suitable Forest Lands

Tentatively Suitable is further refined as Suitable Forest Lands. For the purposes of this analysis, all lands which have a Management Prescription or proposed Management Prescription that precludes timber harvest are eliminated from the tentatively suitable base. The remainder are classified as suitable.

To be considered suitable for harvest, these forested lands must have a Land Use Designation (LUD) that allows commercial timber harvest (LUD III or LUD IV).

For this process, Project Area lands have also been deferred from the suitable base if they have a TLMP Revision LUD prescription that does not permit commercial timber harvest.

Lands withdrawn from the Tentatively Suitable, not contributing to the suitable base considered for this project, include lands allocated to Primitive Recreation (see Chapter One), buffers mandated by the Tongass Timber Reform Act on certain fish-bearing streams, 100-foot buffers around all lakes greater than five acres in size, 500-foot buffers around the saltwater shoreline, 1,000-foot buffers around estuaries, and 330-foot buffers around all known eagle nests. About 22 percent of the CFL (approximately 24,140 acres) within the Project Area is reserved from timber harvest. This leaves a suitable area of approximately 50,400 acres.

Table 3-77 displays the type and amount of adjustments made to the CFL, which lead to the suitable base.

Table 3-77
Adjustments to the CFL, Leading to Suitable acreage

	VCU								
	732	733	735	736	737	738	739	740	Totals
CFL (acres)	2,695	12,338	7,639	9,787	9,624	12,106	15,692	4,659	74,540
-Soils	357	2,147	1,730	2,204	839	1,220	2,561	645	11,703
-Wilderness	0	0	0	0	0	0	0	0	0
-TTRA	125	457	179	398	379	529	694	210	2,971
-Watershed & Experimental	0	0	0	0	0	0	0	0	0
-Estuary buffer	0	327	121	51	162	153	433	0	1,247
-Beach buffer	0	720	1,449	955	580	516	343	401	4,964
-RP zone	1	50	1	2	23	17	44	135	273
-Eagle buffer	0	1	2	3	1	2	0	4	13
-No Harvest Prescription	0	2,967	0	0	0	0	0	0	2,967
Suitable (acres)	2,212	5,669	4,157	6,174	7,640	9,669	11,617	3,264	50,402

SOURCE: GIS, Somrak, 1992

Suitable Base

Previous harvest within the Project Area has largely used clearcut logging methods. The first extensive timber harvests within the Area did not occur until the inception of the Long-Term Sale Contract in the 1950's. Previously harvested stands (second growth) were considered almost exclusively unavailable for timber harvest for this project analysis. About 33 percent of the suitable base or 23 percent of the CFL (approximately 16,850 acres), has been previously harvested from within the North Revilla Project Area.

Potential Unit Pool

In June 1991, a multi-entry layout plan (MELP) analysis was initiated for the North Revilla Project Area. The MELP identified site-specific timber harvest units and supporting road networks for all the Tentatively Suitable within the Project Area. This MELP provided the framework to distinguish between lands which could support timber harvest operations using available technology (potential unit pool) and those which apparently could not. About 43 percent of the suitable base (approximately 21,640 acres), was identified within the potential unit pool. All harvest within the Project Area is proposed from the potential unit pool.

Data from the MELP was developed into a computer database, interphased with existing GIS data, and used in this Project Area analysis. This data base forms the most accurate and representative inventory available for the Project Area, supplemented by 1992 & 93 field review. Table 3-78 displays the adjustments to the suitable base to develop the potential unit pool for the North Revilla Project Area.

Table 3-78
Adjustments to the Suitable Base, leading to the Potential Unit Pool in Acres

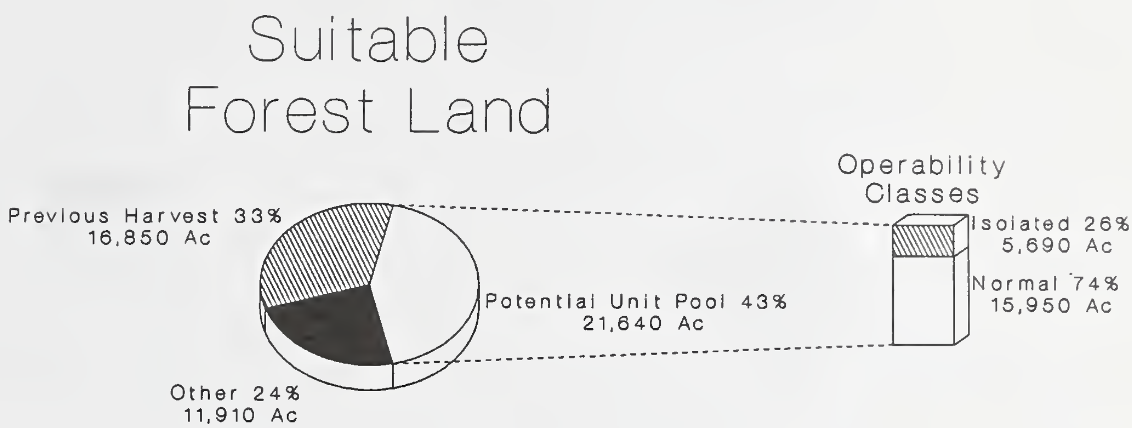
	VCU								
	732	733	735	736	737	738	739	740	Totals
Suitable Base	2,212	5,669	4,157	6,174	7,640	9,669	11,617	3,264	50,400*
-Deferred as Second Growth	0	2,086	1,384	2,391	3,350	3,221	3,207	1,212	16,850*
-Deferred in MELP review	1,355	1,832	719	1,060	763	1,759	3,805	616	11,910*
Potential Unit Pool	857	1,751	2,054	2,723	3,527	4,689	4,605	1,436	21,640*

* Totals are rounded off to the nearest 10 acres
SOURCE: GIS, Somrak, 1992

During the interdisciplinary site-specific MELP design, some lands were deferred from consideration from the potential unit pool for this analysis period. Reasons for deferring the approximately 12,000 acres from consideration included: unstable soils and oversteep slopes or cliffs (63 percent), low probability for regeneration (27 percent), very low volume per acre (6 percent), non-viable economics due to isolation (2 percent), overly dissected with water quality (Class III) streams (1 percent), or not suitable for harvest due to isolation resulting from TTRA or RP buffers (1 percent)

(Nightingale 1992). Figure 3-22 displays the components of the Suitable base and the associated Operability classes.

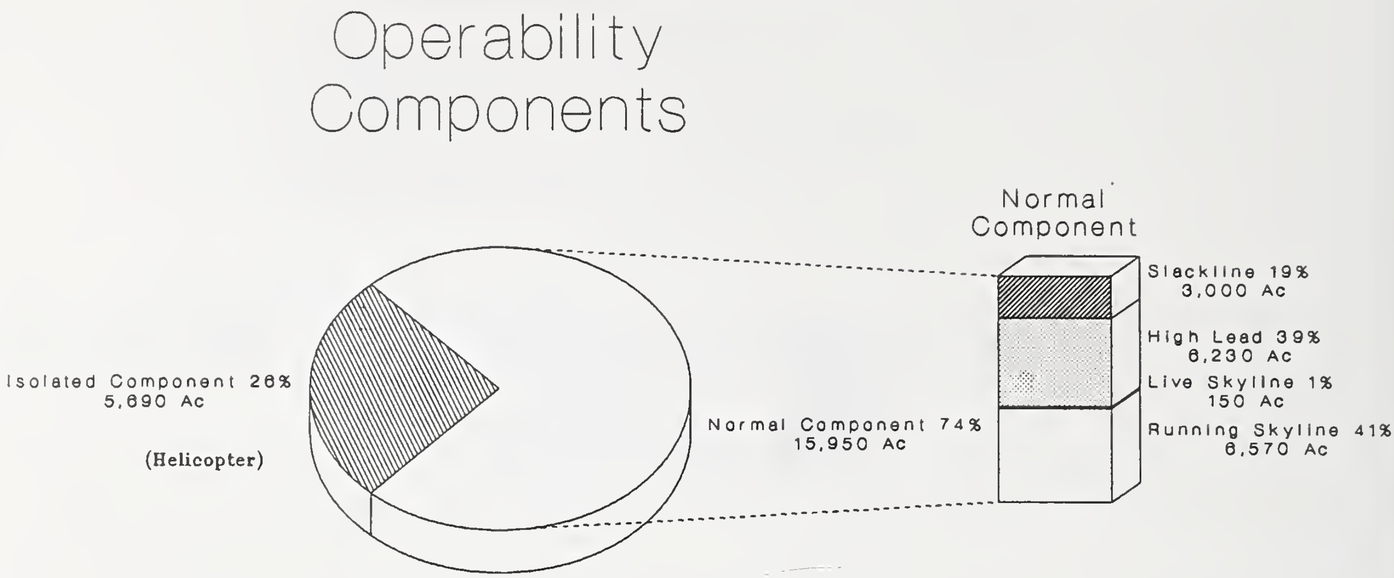
Figure 3-22
Components of the Suitable Base



Operability

The suitable base is further refined for operability. Operability refers to timber harvest operability, and is defined as the type of timber harvest methods generally necessary to move the trees from the stump to landing. There are three different classes of operability: normal (tractor and highlead cable), difficult (longspan skyline), and isolated (helicopter). Figure 3-23 displays the operability as identified during the MELP process.

Figure 3-23
Operability Classes of the Suitable base



These operability classes were assigned by the MELP and do not reflect TLMP estimates for the Tongass National Forest or the Project Area.

No difficult (longspan skyline) component was identified in the MELP process. The percentages listed were a result of the MELP, and do not reflect the TLMP average for the Tongass National Forest.

Volume Class

Commercial forest land in the Tongass National Forest has been classified into volume class. In the mid-1970's the Forest Service contracted an independent consulting firm to assign volume per acre for all lands on the Ketchikan Administrative Area. This inventory estimated timber and land form conditions based upon aerial photo interpretation. This volume-per-acre data was stratified into volume class strata which are used to describe the volume range of timber per acre in thousands of board feet (MBF).

Volume Class 3 is CFL which contains less than eight MBF per acre; examples include unstocked, recently harvested stands and fully stocked, immature stands. Volume Classes 4 through 7 contain trees of merchantable size and with more than 8 MBF per acre. Table 3-79 displays the volume range for each volume class.

Table 3-79
Volume Range Within Volume Class Strata (Based on Timber Type Maps)

Volume Class Strata	Range of net sawlog volume (MBF/Acre)
4	8 - 20
5	20 - 30
6	30 - 50
7	>50

SOURCE: Somrak, 1992

Volume Estimates

Stand inventory data contributing to the original volume-per-acre data, was composed of on-the-ground evaluations of stand characteristics and capabilities. For the DEIS, the Ketchikan Ranger District conducted stand examination, supplementing the original stand inventory throughout the Ketchikan Ranger District, including data within Management Area K-32. These stand exam plots (1,454 plots in stands totaling 14,300 acres) were randomly distributed, based on individual stand characteristics and neither based nor concentrated within any predefined boundaries.

During the field season following the DEIS, additional stand examination was accomplished within the Management Area. This data was targeted within stands representative of the unit pool within the Project Area (616 plots in stands totalling 22,984 acres). When the new stand exam data was weighted into the existing data, the average volume per acre increased from 30.3 MBF/acre to 30.7 MBF/acre. Because of the nominal overall change and because the 1992/93 data was generated from a new, unproven stand exam program ('Superstand'), the original more conservative DEIS-generated volumes were retained for the FEIS.

Based on the above analysis, this data is relevant for Project Area estimations, and is an adequate predictor of volume per acre by volume class. Table 3-80 displays the net volume per acre (including an estimation of utility volume) by volume class.

Table 3-80
Estimated Average Net Volume per Acre (including utility) by Volume Class

Volume Class			
4	5	6	7
25,084 BF/A	31,462 BF/A	41,031 BF/A	45,225 BF/A

BF/A = board feet per acre
SOURCE: Somrak, 1992

These volume-per-acre figures were used to calculate planned harvest unit volumes, in the development of Table 3-81, and to develop mid-market calculations later in this section.

Approximately 32 percent of the Potential Unit Pool in the Project Area is Volume Class 4, 58 percent is Volume Class 5, 10 percent is in Volume Class 6 , and less than 1 percent is in Volume Class 7. Figure 3-24 displays the volume class distribution of the Potential Unit Pool, by percent of area.

Figure 3-24
Project Area Volume Class Distribution, within the Potential Unit Pool

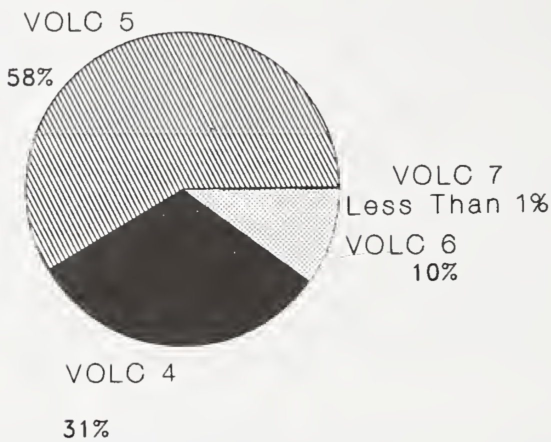


Table 3-81 shows the volume class estimate of harvestable (potential unit pool) volume within the Project Area by VCU. These volume estimates are based solely on current economic and physically feasibility, and do not indicate future potential. Table 3-81 also compares sawtimber CFL to potential unit pool area in volume and acres, by volume class and VCU. Sawtimber CFL does not include approximately 335 acres of Volume Class 3 or 16,850 acres of Second Growth. See Table 3-77, earlier in this section, for other adjustments to the CFL which lead to that volume considered "Suitable".

Table 3-81 shows that VCU 739 contains the greatest amount of volume (147,262 MBF) in the potential unit pool. When divided by its acreage (4,648) it also has the highest average net volume per acre (31.6 MBF). The table also shows that while Volume Class 5 forms the majority of the volume in VCU 739, Volume Class 4 and 5 are quite close in VCU's 732 and 740. The occurrence of Volume Class 7 in the potential unit pool is approximately 30 acres. This is 10 percent of the Volume Class 7 distribution in the sawtimber CFL classification of 300 acres.

Table 3-81
Potential Unit Pool & Sawtimber CFL by Volume Class

VCU #	VCU Name	Volume Class	Potential Unit Pool Volume in MBF	Sawtimber CFL Volume in MBF	Potential Unit Pool in Acres (%)	Sawtimber CFL in Acres(%)
732	Klu Bay	4	9,808	37,200	391 (45)	1,483 (55)
-	-	5	11,609	30,487	369 (43)	969 (36)
-	-	6	4,021	9,971	98 (12)	243 (09)
-	-	7	0	0	0 (00)	0 (00)
-	-		25,438	77,658	858 (100)	2,695 (100)
733	Shrimp	4	19,641	103,697	783 (44)	4,134 (40)
-	Bay	5	27,152	175,149	863 (49)	5,567 (54)
-	-	6	5,170	21,952	126 (07)	535 (05)
-	-	7	0	0	0 (00)	0 (00)
-	-	-	51,963	300,798	1,772 (100	10,236 (100)
735	Hassler	4	12,843	55,686	512 (26)	2,220 (35)
-	Island	5	44,613	119,398	1,418 (71)	3,795 (61)
-	-	6	2,298	9,847	56 (03)	240 (04)
-	-	7	0	0	0 (00)	0 (00)
-	-	-	59,754	184,931	1,986 (100	6,255 (100)
736	Neets Bay	4	28,872	65,294	1,151 (42)	2,603 (35)
-	-	5	40,271	128,837	1,280 (46)	4,095 (55)
-	-	6	13,253	28,106	323 (12)	685 (10)
-	-	7	0	0	0 (00)	0 (00)
-	-	-	82,396	222,237	2,754 (100)	7,383 (100)
737	Fire Cove	4	23,755	48,989	947 (27)	1,953 (31)
-	-	5	72,897	123,394	2,326 (66)	3,922 (63)
-	-	6	10,217	13,786	249 (07)	336 (05)
-	-	7	0	1,538	0 (00)	34 (01)
-	-	-	106,869	187,707	3,522 (100)	6,245 (100)
738	Margaret	4	35,644	71,540	1,421 (31)	2,852 (32)
-	-	5	77,208	154,887	2,454 (53)	4,923 (56)
-	-	6	31,552	41,646	769 (16)	1,015 (11)
-	-	7	0	2,397	0 (00)	53 (01)
-	-	-	144,404	270,470	4,644 (100)	8,843 (100)
739	Traitors	4	17,910	66,247	714 (15)	2,641 (22)
-	-	5	105,838	259,404	3,364 (72)	8,245 (67)
-	-	6	22,157	47,309	540 (12)	1,153 (09)
-	-	7	1,357	9,633	30 (01)	213 (02)
-	-	-	147,262	382,593	4,648 (100)	12,252 (100)
740	Francis	4	20,995	44,599	837 (57)	1,778 (52)
-	Cove	5	18,279	50,119	581 (40)	1,593 (46)
-	-	6	1,559	3,118	38 (03)	76 (02)
-	-	7	0	0	0 (00)	0 (00)
-	-	-	40,833	97,836	1,456 (100)	3,447 (100)
	Totals		658,919MBF	1,724,230MBF	21,640 acres	57,356 acres

SOURCE: Somrak, 1992

Proportion of Volume Class Strata 6 and 7 Proposed for Harvest

The Tongass Timber Reform Act of 1990 (301c2) modified the long-term contracts to:

> "Eliminate the practice of harvesting a disproportionate amount of old growth timber by limiting the volume harvested over the rotation in Volume Classes 6 and 7, as defined in TLMP and supporting documents, so that the proportion of volume harvested in these classes within a contiguous management area does not exceed the proportion of volume currently represented by these classes within the management area."

Forest Service Handbook (FSH) 2409.18, Region 10 Supplement No. 2409.18-92-5 contains the procedure for calculating and measuring compliance with the proportionality requirements of the TTRA. The baseline for measuring proportionality is the date the TTRA was signed into law (November, 1990).

Volume class determination for proportionality is based upon net sawlog inventory volume class strata as determined from the Management Area's timber type (TIMTYP) map, per Forest Service Handbook (FSH) direction. This proposed action encompasses only a portion of Management Area K32. Thus, acres of volume class strata estimates used in this section of the document will differ from stand acre estimates used in other sections of the document.

It is important to note that the TTRA proportionality requirement is based upon volume actually harvested, as opposed to volume scheduled or planned for harvest. Consequently the measure of compliance will occur after the timber harvest for a given management area is actually completed and based upon the timber type map.

For the purpose of this analysis, proportionality calculations considered all long-term harvest which occurred from the TTRA date (11/90), plus all harvest proposed for this project.

Table 3-82 displays the proportionality of Management Area K32 at the time the TTRA was signed into law, and the projected proportionality of each alternative. Alternative 1 reflects only the proportionality as a result of timber harvest since TTRA and proposes no timber harvest at this time. Proportionality for Alternatives 2 through 6 are based on the remaining acres as displayed for Alternative 1.

Table 3-82
Proportion of Volume Classes 6 and 7 Proposed for Harvest

Management Area K32	Total Timber Base (acres)	Volume Class Strata 6 & 7 (acres)	Proportionality (percent)*	Difference (percent)**
Original K32 Total	83,049	7,328	8.82%	NA
Alt. 1, (Timber	- 377	- 0		
harvested since 11/90)	82,672	7,328	8.86%	+0.04%
Alt. 2, Projected	-8,232	- 762		
Remaining K32 Total	74,440	6,566	8.82%	+0.00%
Alt. 3, Projected	-5,734	- 507		
Remaining K32 Total	76,938	6,821	8.87%	+0.05%
Alt. 4, Projected	-5,920	- 383		
Remaining K32 Total	76,752	6,945	8.91%	+0.09%
Alt. 5, Projected	-6,424	- 549		
Remaining K32 Total	76,248	6,779	9.05%	+0.23%
Alt. 6, Projected	-6,568	- 515		
Remaining K32 Total	76,104	6,813	8.95%	+0.13%

* Proportionality = Acres of Volume Classes 6 and 7 divided by the Total Timber Base.
** A positive difference indicates a projected proportion of volume classes 6 & 7 remaining in the management area to be greater than that which existed prior to the proposed alternative. A negative difference would indicate a lower projected proportion of volume classes 6 & 7 remaining in the management area.
SOURCE: Somrak, 1992, GIS/Nightingale, 1993

All alternatives as presented in this document are projected to meet the proportionality requirements of the TTRA. All alternatives are projected to result in a remaining proportion of Volume Classes 6 and 7 that is equal to or higher than their proportion in K32 when the TTRA was signed into law.

Effects of the Alternatives

Direct, Indirect, and Cumulative Effects

Proposed Harvest by Alternative

At this time no increases or decreases to the CFL can be assumed. Proposed harvest will change the form of the CFL from old-growth to second-growth stands. Decreases in the harvestable component will be mirrored by increases to the second-growth component of the CFL. Similarly, no changes would take place after harvest to the overall amount of suitable as it includes second growth. The percentage of area in or reverting to second growth for any given alternative, would equal the end of offering (EOO) harvested of the suitable, as shown in Tables 3-81 thru 3-86.
Table 3-83 displays the acres and percentage of each volume class proposed for harvest, by alternative.

Table 3-83
Distribution Percent & Acres, for Proposed Harvest Units (by Volume Class and Alternative)

	Volume Class 4		Volume Class 5		Volume Class 6		Volume Class 7		Total
Alt.	Acres	%	Acres	%	Acres	%	Acres	%	Acres
2	2,420	30	5,050	61	762	9	0	0	8,232
3	1,712	30	3,515	61	507	9	0	0	5,734
4	1,841	31	3,696	62	383	7	0	0	5,920
5	2,213	35	3,662	57	533	8	16	0 *	6,424
6	1,997	30	4,056	62	515	8	0	0	6,568
Pool	6,806	31	12,635	59	2,171	10	33	0 *	21,645**

* less than 1/2 percent
** differences between tables displaying Potential Unit Pool are due to rounding.
SOURCE: GIS/Nightingale, Somrak, 1993

Tables 3-84 through 3-88 display the acres harvested by alternative in each VCU by volume class strata. Since Alternative 1 proposes no timber harvest, it is not portrayed.

Table 3-84

Proposed Unit Harvest by VCU and Volume Class Strata for Alternative 2, in Acres

VCU	Volume Class 4	Volume Class 5	Volume Class 6	Volume Class 7	Total Proposed Harvest
732	91	154	0	0	245
733	334	465	46	0	845
735	189	505	32	0	726
736	357	492	27	0	876
737	405	823	100	0	1,328
738	702	1,223	372	0	2,297
739	321	1,356	164	0	1,841
740	21	32	21	0	74
Totals	2,420	5,050	762	0	8,232

SOURCE: GIS/Nightingale, Somrak, 1993

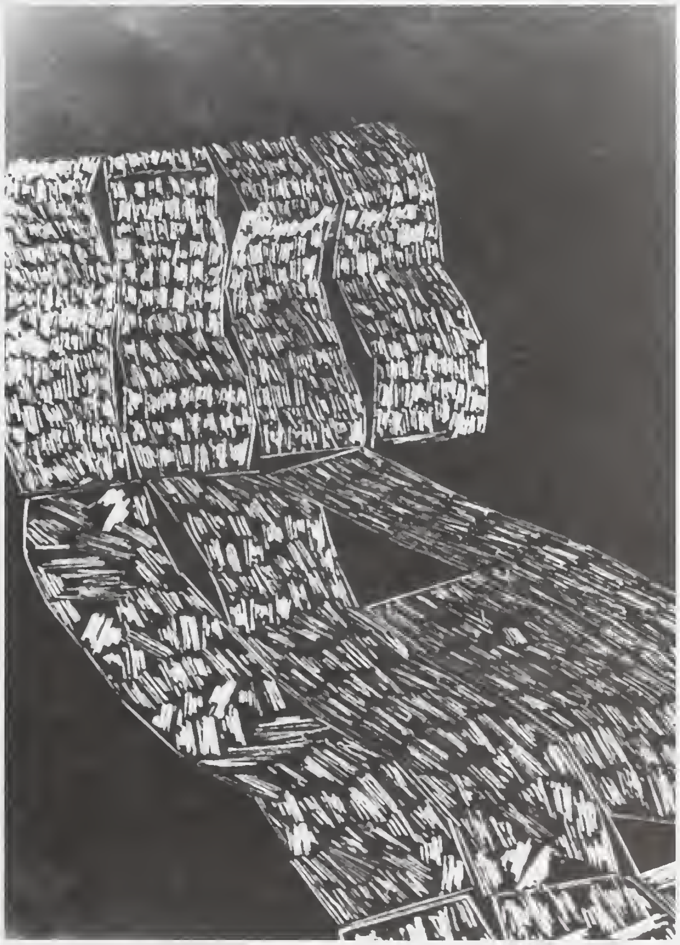


Table 3-85
Proposed Unit Harvest by VCU and Volume Class Strata for Alternative 3, in Acres

VCU	Volume Class 4	Volume Class 5	Volume Class 6	Volume Class 7	Total Proposed Harvest
732	0	0	0	0	0
733	226	279	29	0	534
735	70	440	36	0	546
736	475	363	0	0	838
737	103	298	53	0	454
738	557	855	211	0	1,623
739	228	1,280	173	0	1,681
740	53	0	5	0	58
Totals	1,712	3,515	507	0	5,734

SOURCE: GIS/Nightingale, Somrak, 1993

Table 3-86
Proposed Unit Harvest by VCU and Volume Class Strata for Alternative 4, in Acres

VCU	Volume Class 4	Volume Class 5	Volume Class 6	Volume Class 7	Total Proposed Harvest
732	0	0	0	0	0
733	295	479	99	0	873
735	201	622	32	0	855
736	369	376	0	0	745
737	458	911	45	0	1,414
738	330	874	98	0	1,302
739	77	402	83	0	562
740	111	32	26	0	169
Totals	1,841	3,696	383	0	5,920

SOURCE: GIS/Nightingale, Somrak, 1993

Table 3-87
Proposed Unit Harvest by VCU and Volume Class Strata for Alternative 5, in Acres

VCU	Volume Class 4	Volume Class 5	Volume Class 6	Volume Class 7	Total Proposed Harvest
732	231	140	0	0	371
733	282	279	84	0	645
735	79	228	8	0	315
736	268	276	91	0	635
737	411	852	88	3	1,354
738	577	957	93	0	1,627
739	254	898	143	13	1,308
740	111	32	26	0	169
Totals	2,213	3,662	533	16	6,424

SOURCE: GIS/Nightingale, Somrak, 1993

Table 3-88
Proposed Unit Harvest by VCU and Volume Class Strata for Alternative 6, in Acres

VCU	Volume Class 4	Volume Class 5	Volume Class 6	Volume Class 7	Total Proposed Harvest
732	0	0	0	0	0
733	316	444	37	0	797
735	149	595	36	0	780
736	520	427	0	0	947
737	154	351	66	0	571
738	530	986	243	0	1,759
739	275	1,253	128	0	1,656
740	53	0	5	0	58
Totals	1,997	4,056	515	0	6,568

SOURCE: GIS/Nightingale, Somrak, 1993

Tables 3-81 through 3-93 display acres previously harvested and acres in proposed harvest units, by VCU, in each action alternative. Also shown are total percentages of suitable land, CFL, and overall land area harvested by the end of this project (2004). Alternative 1 proposes no timber harvest and is not displayed.

Table 3-89
Acres of Forested Land Harvested for Alternative 2, by VCU

VCU	Past Harvest	Proposed Harvest	Total Harvest	Total Percent Harvested Suitable	CFL	Land Area
732	0	245	245	11	9	5
733	2,086	845	2,931	52	24	17
735	1,384	726	2,110	51	29	22
736	2,391	876	3,267	53	34	25
737	3,350	1,328	4,678	61	48	34
738	3,221	2,297	5,518	57	45	30
739	3,207	1,841	5,048	44	32	20
740	1,212	74	1,286	39	28	19
Totals	16,851	8,232	25,083	50	34	23

SOURCE: GIS/Nightingale, Somrak, 1993

Table 3-90
Acres of Forested Land Harvested for Alternative 3, by VCU

VCU	Past Harvest	Proposed Harvest	Total Harvest	Total Percent Harvested Suitable	CFL	Land Area
732	0	0	0	0	0	0
733	2,086	534	2,620	46	21	15
735	1,384	546	1,930	46	25	20
736	2,391	838	3,229	52	33	25
737	3,350	454	3,804	50	40	28
738	3,221	1,623	4,844	50	40	26
739	3,207	1,681	4,888	42	31	19
740	1,212	58	1,270	39	27	18
Totals	16,851	5,734	22,585	45	30	21

SOURCE: GIS, Somrak, 1993

Table 3-91
Acres of Forested Land Harvested for Alternative 4, by VCU

VCU	Past Harvest	Proposed Harvest	Total Harvest	Total Percent Harvested: Suitable	CFL	Land Area
732	0	0	0	0	0	0
733	2,086	873	2,959	52	24	17
735	1,384	855	2,239	54	29	24
736	2,391	745	3,136	51	32	24
737	3,350	1,414	4,764	62	50	35
738	3,221	1,302	4,523	47	37	24
739	3,207	562	3,769	32	24	15
740	1,212	169	1,381	42	30	20
Totals	16,851	5,920	22,771	45	30	21

SOURCE: GIS/Nightingale, Somrak, 1993

Table 3-92
Acres of Forested Land Harvested for Alternative 5, by VCU

VCU	Past Harvest	Proposed Harvest	Total Harvest	Total Percent Harvested: Suitable	CFL	Land Area
732	0	371	371	17	14	7
733	2,086	645	2,731	48	22	16
735	1,384	315	1,699	41	22	18
736	2,391	635	3,020	49	31	23
737	3,350	1,354	4,704	62	49	35
738	3,221	1,627	4,848	50	40	26
739	3,207	1,308	4,515	39	29	18
740	1,212	169	1,381	42	30	20
Totals	16,851	6,424	23,269	46	31	21

SOURCE: GIS, Somrak, 1993

Table 3-93
Acres of Forested Land Harvested for Alternative 6, by VCU

VCU	Past Harvest	Proposed Harvest	Total Harvest	Total Percent Harvested Suitable	CFL	Land Area
732	0	0	0	0	0	0
733	2,086	797	2,883	51	23	16
735	1,384	780	2,164	52	28	23
736	2,391	947	3,338	54	34	26
737	3,350	571	3,921	51	41	29
738	3,221	1,759	4,980	52	41	27
739	3,207	1,656	4,863	42	31	19
740	1,212	58	1,270	39	27	18
Totals	16,851	6,568	23,419	47	32	21

SOURCE: GIS, Somrak, 1993

When including past harvest, Alternative 2 would result in the harvest of 50 percent of the suitable forest land. Alternative 3 would result in the harvest of 45 percent of the suitable forest land when added to past harvest. Alternative 4 would harvest 45 percent of the total suitable forest land. Alternative 5 would harvest 46 percent of the suitable forest land and Alternative 6 would total 47 percent of the suitable forest land. Consequently, current Standards and Guidelines would allow additional harvest entries after implementation of any of the proposed alternatives.

Table 3-94 displays the percent of the MELP potential unit pool harvested by VCU for each Alternative.

Table 3-94
Percentage of Potential Unit Pool Harvested by Alternative

VCU	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
732	0	29	0	0	43	0
733	0	48	31	50	37	40
735	0	35	27	41	15	38
736	0	32	31	27	23	35
737	0	38	13	40	38	16
738	0	49	35	28	35	38
739	0	40	37	12	28	36
740	0	5	4	12	12	4
Totals	0	38	27	27	30	30

SOURCE: Somrak, 1993

Projected Harvest through completion of the KPC Long-Term Contract, 2004

The TLMP Revision (1991a) 10-Year Timber Sale Schedule for the KPC Long-Term Contract calls for another entry into the Project Area to occur before 2004, at a harvest level of approximately 46 MMBF. This additional entry was the impetus for Alternative 2, so that the ability of the area to sustain this level of cut or offer additional options to the decision maker would be explored. Alternative 2 could provide the volume as scheduled by the Forest Plan.

In order to estimate the amount of harvest by VCU, where future harvest could occur for Alternatives 3 through 6, the percentage of harvest units by VCU for Alternative 2 was applied. By pro-rating this percentage occurrence, it was possible to estimate the second entry amounts by VCU. This represents the total projected harvest within the Project Area through the life of the Long-Term Contract. This is displayed in Tables 3-95 through 3-100.

Table 3-95
Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 1

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	0	0	245	245	11
733	0	0	845	845	15
735	0	0	726	726	18
736	0	0	876	876	14
737	0	0	1,328	1,328	17
738	0	0	2,297	2,297	24
739	0	0	1,841	1,841	16
740	0	0	74	74	2
Totals	0	0	8,232	8,232	16

SOURCE: Somrak, 1993

Table 3-96
Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 2

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	245	11	0	245	11
733	845	15	0	845	15
735	726	18	0	726	18
736	876	14	0	876	14
737	1,328	17	0	1,328	17
738	2,297	24	0	2,297	24
739	1,841	16	0	1,841	16
740	74	2	0	74	2
Totals	8,232	16	0	8,232	16

SOURCE: Somrak, 1993

Table 3-97
Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 3

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	0	0	245	245	11
733	534	9	311	845	15
735	546	13	180	726	18
736	838	14	38	876	14
737	454	6	874	1,328	17
738	1,623	17	674	2,297	24
739	1,681	14	160	1,841	16
740	58	2	16	74	2
Totals	5,734	11	2,498	8,241	16

SOURCE: Somrak, 1993

Table 3-98
Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 4

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	0	0	245	245	11
733	873	15	0	873	15
735	855	21	0	855	21
736	745	12	131	876	14
737	1,414	19	0	1,414	19
738	1,302	13	995	2,297	24
739	562	5	1,279	1,841	16
740	169	5	0	169	5
Totals	5,920	12	2,650	8,570	17

SOURCE: Somrak, 1993

Table 3-99

Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 5

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	371	17	0	371	17
733	645	11	200	845	15
735	315	8	411	726	18
736	635	10	241	874	14
737	1,354	18	0	1,354	18
738	1,627	17	670	2,297	24
739	1,308	11	533	1,841	16
740	169	5	0	169	5
Totals	6,424	13	2,055	8,479	17

SOURCE: Somrak, 1993

Table 3-100

Direct and Indirect Effects of Timber Harvest on the Project Area for Alt. 6

VCU	Acres of Proposed Harvest	Percent of Suitable	Acres of Potential Harvest by 2004	Acres of Total Harvest at 2004	Percent of Suitable Total at 2004
732	0	0	245	245	11
733	797	14	48	845	15
735	780	19	0	780	19
736	947	15	0	947	15
737	571	7	757	1,328	17
738	1,759	18	538	2,297	24
739	1,656	14	185	1,841	16
740	58	2	16	74	2
Totals	6,568	13	1,789	8,357	17

SOURCE: Somrak, 1993

By the year 2004 (when the Long-Term Contract with KPC expires), approximately 17 percent of the suitable base is scheduled for harvest. The scheduled acreage combined with the acreage previously harvested equals approximately 51 percent of the suitable base. Between the end of the Long-Term Contract in 2004 and by the end of the forest rotation in approximately 2140, all suitable volume would be scheduled for harvest, to attain the desired future condition. Future timber harvest within the Project Area could occur as summarized in Table 3-101.

Table 3-101
Cumulative Effects of Timber Entry into Project Area

Alt	Acres of Proposed Harvest	Percent of Suitable (Direct)	Acres of Potential Harvest 2000–2004	Total Percent Suitable 2004 (Indirect)	Acres of Future Harvest 2004–2140	Percent of Suitable 1954–2140 (Cumul.)	Percent of CFL Harvested 1954–2140
1	0	0	8,232	16	25,310	100	68
2	8,232	16	0	16	25,310	100	68
3	5,734	11	2,498	16	25,310	100	68
4	5,920	12	2,650	17	24,980	100	68
5	6,424	13	2,055	16	25,071	100	68
6	6,568	13	1,789	16	25,193	100	68

SOURCE: Somrak, 1993

Road Construction & Incidental Timber Harvest

A result of the proposed harvest of timber, identified in designed harvest units, is the harvest of timber along designated Right-of-Ways (ROW). ROW's are designed to be the most economical access to the present and future timber resource, in line with protecting and serving other resource needs and meeting Forest Service Standards and Guidelines. Consequently the volume and type of timber harvested along ROW's is considered incidental to the proposed timber harvest. Table 3-102 displays the estimated volume and acres of ROW timber proposed for incidental harvest with each alternative. These estimates were generated electronically, from Timber Type maps, through the Ketchikan Area's Geographic Information System (GIS). Actual area and volume will be established prior to the offering. For more ROW information see the Roads and Facilities Section of this chapter.

Table 3-102
ROW Timber Harvest

Alt.	Acres of ROW Timber Harvest	Volume of ROW Timber Harvest in MBF
1	0	0
2	491	16,424
3	237	7,982
4	269	8,878
5	445	14,839
6	236	7,982

SOURCE: Somrak, 1993

After completion of the Long-Term Sale Contract, and until the end of the current rotation and conversion of old-growth stands (2140), TLMP Revision (1991a) Table 3-134 identifies the North Revilla Project Area (F-Primary Area) as contributing 10 MMBF Net Sawlog annually towards the ASQ (Allowable Sale Quantity). This FORPLAN based schedule covers a 15-decade period, per planning regulations, and proposes volumes aimed at a sustained yield. These estimates include the scheduling of old growth as well as second growth, based on Alaska Region growth and yield models.

Annual timber sale targets may vary depending on Congressional direction and funding. Economical harvest methodologies will tend to restrict harvest to a number of entries, rather than actually harvesting on an annual or yearly basis.

Logging Systems

Yarding is the process of conveying logs from the stump to the landing. This can be done using ground-based equipment, cable logging systems, or helicopters. The method used depends upon many factors including access, topography, slope, and resource protection needs (suspension requirements).

Ground Based Yarding

Moist and soft soil conditions along with steep slopes of the Project Area are difficult for operation of ground-based equipment. Except for a limited amount of shovel logging with track mounted log loaders, there has been little opportunity for this type of equipment. Recently, shovel logging with hydraulic log loaders has added a new dimension to this type of yarding. These new machines are more stable with a lower center of gravity, and are lighter and more agile with larger tracks having a lighter footprint. The objective is to walk a shovel yarder into and through a unit, using the swing boom motion of the loader to swing logs into windrows, then swing the windrows to new locations, then ultimately to a road or landing. While the Project Area MELP process classified units as either cable or helicopter yarded, portions of cable units may be suitable for shovel yarding. Though the decision to specify shovel yarding within a given unit is made at the time of unit layout, an analysis has been conducted on the potential unit pool to determine shovel yarding feasibility.

Table 3-103 illustrates the number and extent of potential shovel yarding areas over 3 acres in size, adjacent to and within 300 feet of a road or spur, with slopes less than 20 percent. Some acres proposed for cable yarding could actually be shovel yarded. Shovel yarding will occur only in those areas where it will not interfere with economical cable settings containing slopes in excess of 20 percent.

Table 3-103
Potential for Shovel Yarding

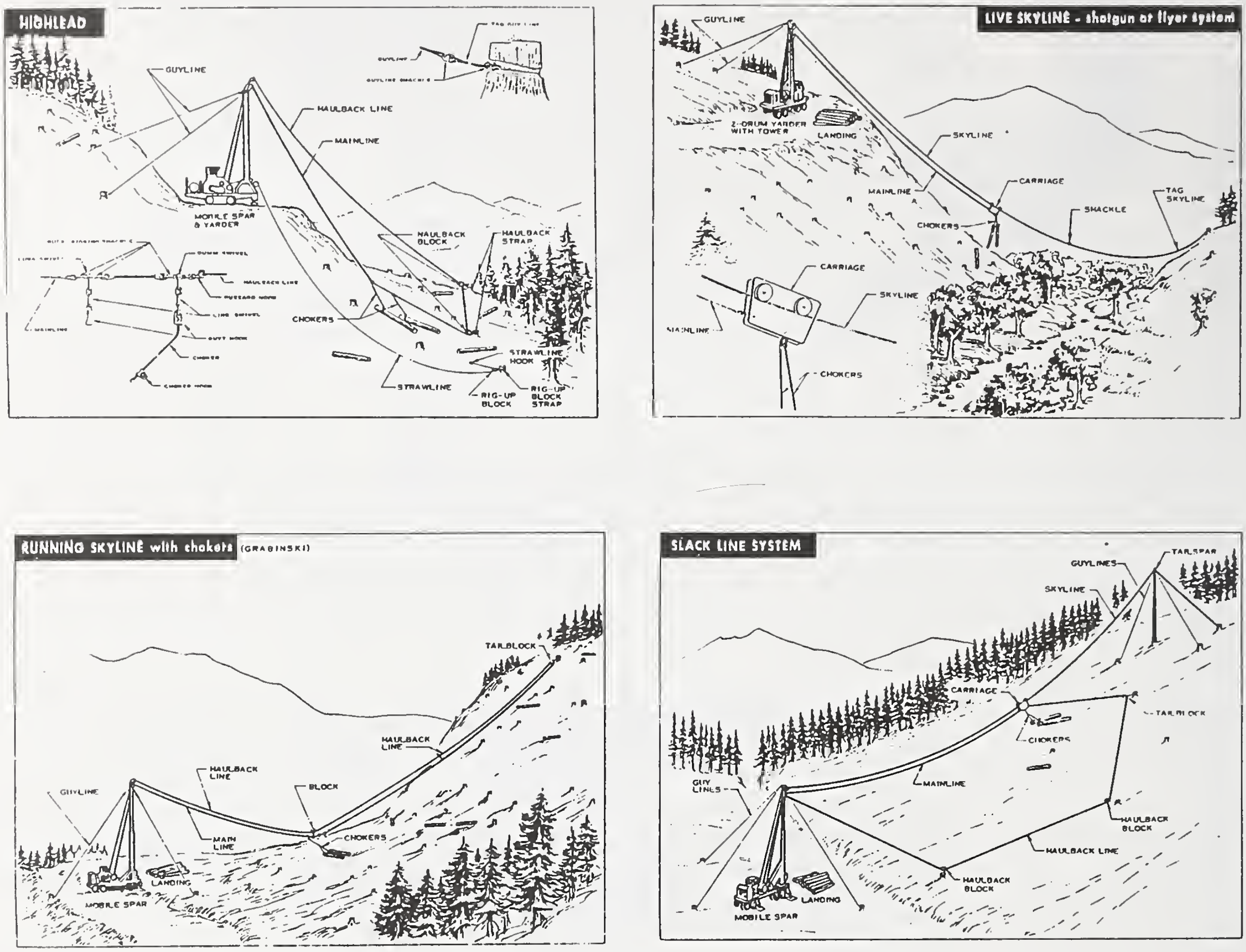
Alt.	Number of Units in Proposed Alternative	Number of Units with Shovel Yarding Potential	Acreage in Proposed Alternative	Acreage with Shovel Yarding Potential
1	0	0	0	0
2	205	134	8,232	2,223
3	124	83	5,734	1,286
4	123	69	5,920	1,300
5	186	121	6,424	1,828
6	137	96	6,568	1,698

SOURCE: Somrak, 1993

Cable Yarding

Cable yarding through out the Ketchikan Area is comprised of approximately 40 percent slackline yarding, 35 percent running skyline, and 25 percent highlead (Klein 1992). On the Project Area, highlead and small skyline systems (rigged live or running) account for the majority of the timber harvest methods proposed in each alternative. Operators use the most economical method available provided it meets the suspension requirements of each unit. These harvest methods provide partial suspension in the majority of uses, but when appropriate, a method capable of providing increased suspension is identified. Figure 3-25 illustrates four systems of cable yarding.

Figure 3-25
Cable Yarding Systems



Most of the timber in the Project Area will be removed with cable yarding equipment.

Highlead systems were previously used more than any other cable system. Suspension requirements, as well as entry into more difficult terrain with longer reaches, favors systems with expanded capabilities. The term highlead refers to the location of the mainline block which is elevated above the ground by the spar. The mainline block (bull block) provides vertical lift enabling the logs to override obstacles, and not plow furrows, as the turn is skidded to the landing. This system works best during uphill yarding.

Running skyline systems utilize a carriage supported by the mainline and haulback so that the lines can be smaller in diameter than a live or standing skyline for a given payload. This increases reach capabilities. When used with a highlead yarder it is commonly referred to as a "Grabinski" configuration. The Grabinski (with chokers) and the running skyline with mechanical grapple and mobile yarder, are currently the most commonly used yarding methodologies on private lands in the Ketchikan Area. These methods have been identified to harvest at least 33 percent of the Project Area, depending on the alternative.

Live skyline systems feature a skyline cable whose length can be changed during the yarding cycle, raising or lowering the carriage and/or turn of logs. The mainline on a highlead yarder is used as a skyline and the haulback is used as the mainline, to move the carriage up or down the skyline depending on configuration. The most common configuration is called the shotgun and is only used for uphill yarding.

Slackline systems are a configuration of a live skyline. They are employed where needed to meet log suspension requirements, when required landing size and tailhold strength are achievable. These are normally the largest yarders employed on the Ketchikan Administrative Area and most often use a tower in excess of 100 feet. This method is quite capable of providing partial or even full suspension when necessary. Slackline yarders generally have a much greater line capacity than a high lead yarder, and are also different in that the drums cannot both turn in the same direction, nor can they be interlocked to provide lifting tension when used in a highlead or running skyline configuration.

Helicopter Yarding

Helicopter yarding is proposed to play a major role in Alternatives 2 and 4. Helicopter yarding has been successfully used on all areas of the Tongass National Forest within recent years. On the Stikine Area approximately 12 MMBF was harvested on the Deer Island Timber Sale less than 25 miles to the northwest of the North Revilla Project Area, and a sale is being proposed for the Bradfield Canal Area less than 30 miles to the north of Project Area. On the Ketchikan Administrative Area, Revilla Island, the Painted Peak Timber Sale (4 MMBF) and volume on the Brown Mountain Timber Sale was helicopter yarded. In this type of yarding logs are lifted off the ground and flown to a landing specially prepared for helicopter yarding. Logs are lifted singly or several at a time depending on size, weight, and log proximity. This yarding system causes the least amount of disturbance to the vegetative cover and impact to the soil resource, but has the highest yarding cost. The economic feasibility of helicopter yarding is more closely affected by market values than cable yarding. See Table 3-104 for a breakdown of yarding systems proposed for all alternatives.

Table 3-104
Distribution Percent of Proposed Yarding System (by Acres per Alternative)

Yarding Type	Alternative 1	2	3	4	5	6	Total Unit Pool (Total Operable)
Running Skyline (RS)	0	34	40	35	36	33	30
Highlead (HL)	0	31	39	22	35	32	29
Slackline (SL)	0	14	21	16	15	17	14
Helicopter (HE)	0	21	0	26	13	17	26
Live Skyline (LS)	0*	0*	0 *	1	1	1	1

* Less than 1/2%
SOURCE: Somrak 1993

Effects of Proposed Yarding Systems

All yarding is proposed in conformance with national and regional standards and guidelines. Yarding systems were assigned to settings in an interdisciplinary process to minimize any potential or foreseen effects. Field evaluations during the Layout process will ensure the yarding system assigned will provide the required suspension as specified by reviewing specialists. For effects analysis see the Soils section of this chapter.

Timber Economics/ Economic Efficiency Analysis

Current Forest Service Handbook direction (FSH 2409.18 ;Amdmt. 90-1 & Supp. 6) requires an economic efficiency analysis to compare benefits and costs of a project. Values used in the analysis must reflect middle market timber value estimates that are based on a median or middle level of the timber market. In order to account for market fluctuations, weighted average timber values over the past 10 years are used in the analysis.

Forest Service Handbook direction also stipulates that timber harvest projects provide at least 60 percent of normal profit, which must be included when calculating costs. This economic efficiency analysis is performed by comparing expected gross revenues to estimated costs and arriving at an estimate of net revenues.

Pond log values represent the delivered price of logs at the mill minus the cost to manufacture them into useable products. Pond log values are closely related to volume class data which incorporates log size, grade, and species. On the Ketchikan Administrative Area, the lower volume classes generally have a higher yellowcedar component, which has the highest selling value. On the Project Area, this results in a disproportionately high Pond Log Value for the lower volume classes instead of lower, which would reflect the true value of the high elevation (small diameter, low grade) yellow cedar timber.

Stump-to-truck logging costs are subtracted from the pond log values to arrive at a delivered price to the mill. Stump-to-truck logging costs include felling, bucking, yarding, loading, and administrative costs. Logging costs are closely tied to volume per acre (represented by volume class data). Generally the higher the volume per acre the lower the logging cost. Table 3-105 shows the stump-to-truck logging costs and associated pond values for each volume class.

Table 3-105
Summary of Stump to Truck Logging Costs and Pond Values/MBF by Volume Class Strata

	Volume Class (Dollar Amount per MBF)			
	4	5	6	7
Highlead - Uphill	$183.31	$130.21	$118.74	$103.56
- Downhill	$211.78	$148.70	$135.59	$117.53
Skyline - Running	$160.19	$120.32	$109.86	$97.67
- Live	$176.91	$126.97	$116.18	$101.28
- Standing (long span)	$216.41	$153.48	$140.52	$122.35
Slackline	$218.44	$155.05	$141.90	$124.17
Shovel	$156.58	$111.38	$102.60	$89.30
Helicopter	$200.22	$178.84	$172.13	$163.54
Pond Log Value	$342.42	$367.86	$331.21	$365.64
60% Profit Margin	$49.60	$51.15	$51.34	$51.92
Pond Value less Profit	$292.82	$316.71	$279.87	$313.72

SOURCE: Klein, Nightingale, Somrak, 1992

In addition to logging costs, costs related to truck haul, dump, tow, raft, specified road construction and reconstruction, temporary road construction, Log Transfer Facility (LTF) construction, camp development, and camp mobilization costs need to be considered when determining the economics of timber sales. For the purposes of this analysis, stump-to-truck logging costs plus haul, dump, tow, and raft costs (etc.) were all combined into a total transportation cost center. All capital investment costs, such as road, bridge, and LTF construction were combined into a total construction cost center. Table 3-106 summarizes these costs by alternative. Because Alternative 1 does not propose any timber harvest it is not displayed in the table.

Table 3-106
Summary of Total Transportation and Construction Costs, in Dollars

Alternative	Transportation Costs*	Construction Costs*	Total Costs*	Ave. Cost /MBF
Alternative 2	52,117,000	29,373,000	81,490,000	$325.20
Alternative 3	32,295,000	17,946,000	50,241,000	$288.51
Alternative 4	37,452,000	17,756,000	55,208,000	$310.42
Alternative 5	38,615,000	24,827,000	63,442,000	$328.98
Alternative 6	40,206,000	17,327,000	57,533,000	$289.80

* rounded to the nearest thousand
SOURCE: Somrak, Rhodes, Demmert, & Van Weel/NET 4T, 1993

— Costs per MBF are lowest for Alternatives 3 and 6, which fits the theme of those alternatives.

— Total costs per MBF were highest for Alternative 5 ($328.80/MBF), since that alternative would need substantial amounts of road to reach more and smaller units, also resulting in the highest construction costs per MBF (see Table 3-108).

— Alternative 4 had the largest unit size, in line with wildlife management practices, however, it offset the relative efficiencies of large unit size with increased roading for a more dispersed overall unit layout and resulting in the highest transportation cost per MBF for all alternatives ($210.58/MBF,see Table 3-108).

— Transportation costs per MBF are lowest for Alternative 3 ($185.45) because it includes no helicopter logging. The logging costs of successive entries can be expected to increase, due to the projected increase in the proportion of isolated volume within the Project Area. It is much more difficult to develop these future costs; however, Alternative 3 would decrease the area's ability to offset the cost of harvesting the difficult and isolated component (see Operability, this section).

— The high costs associated with Alternative 2 reflect the higher costs of having to access more marginal timber to attain higher volume targets. This essentially depicts the higher costs that may be associated with any future entry, harvesting timber in areas increasingly more difficult to road. A future entry, without the

volumes of Alternative 2 to carry it, could have a net value (see Table 3-108) lower than Alternative 2.

- Alternatives 2, 4, 5, and 6 include helicopter logging, which is a more expensive yarding system than cable logging. In response to considerable public comment, the Forest Service revised the method for calculating helicopter costs. In the DEIS, helicopter costs were taken directly from the Timber Appraisal Handbook and adjusted for the appropriate mid-market base period. For the Final EIS, helicopter costs were estimated using the HELI-PACE computer program which produces site-specific helicopter costs based upon volume per acre, average piece size, average yarding distance, silvicultural system (residual canopy closure), average elevation of harvest unit, and landing elevation. Rather than using HELI-PACE to produce a helicopter cost for each volume class, helicopter costs were developed for each alternative, using the volume class data specific to that alternative. This cost then was used in the Net4T computer analysis of each alternative. Table 3-107 compares the helicopter costs used in the Draft EIS to the ones used in this Final EIS.

Table 3-107
Helicopter Costs

DEIS				FEIS				
VC 4	VC 5	VC 6	VC 7	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
199.52	191.77	168.71	156.04	249.80	N/A	249.98	251.18	248.72

Estimated net timber value (stumpage) is arrived at by subtracting all associated costs from the pond value for all proposed harvest units in each action alternative. Consequently, individual units which may be uneconomical to harvest by themselves are offset by combining them with other units which are more economical to harvest. This results in less productive lands or lands where the timber is highly defective being made more economically viable for timber harvest. These lands are then brought under management, thereby increasing future timber yields, and postponing entry into more environmentally sensitive areas.

These projected construction costs, transportation costs and pond log values are estimates, not actual costs, which form a constant by which all alternatives may be compared. Before the timber is released to KPC in individual offerings, the volume within the units and right of ways will be cruised and appraised, to determine the actual volume and value of the timber. Because all action alternatives are measured against the same yardstick of estimated costs, it is appropriate to rank the alternatives in order by net value. Table 3-108 shows the estimated value and ranking of each alternative based upon the net value. Net values are shown rounded, since the figures are based on estimates. Because Alternative 1 has no timber harvest costs or values, it is not listed.

Table 3-108
Summary of Harvest Unit Estimated Stumpage Values by Alternative, per MBF

Alternative	Estimated Total Volume (MBF)	Total Pond Value*	Total Trans. Costs**	Total Const. Costs***	Estimated Net Value	Rank Order
Alternative 2	250,362	$306.35	$207.98	$117.21	-$18.84	4th
Alternative 3	174,141	$304.53	$185.45	$103.05	+$16.03	2nd
Alternative 4	177,850	$305.78	$210.58	$ 99.83	-$ 4.63	3rd
Alternative 5	192,844	$306.44	$200.24	$128.74	-$22.53	5th
Alternative 6	198,528	$307.30	$202.52	$ 87.28	+$17.50	1st

* values are meant for comparative purposes only. Higher values in Alternative 4 and 5 indicate greater amounts of higher elevation units and a corresponding increased yellowcedar component.
** Transportation costs include all costs not associated with capital investments or costs normally connected to road construction, such as: fall, buck, yard, sort, load, haul, dump, raft and tow.
*** Construction costs include costs associated with LTF development, road construction and re-construction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, such as bulkheads, bridges and culverts.
SOURCE: Somrak, Rhodes, Demmert & VanWeel/NET-4T, 1993

Based on this analysis, not all alternatives show a positive net stumpage. However these costs for temporary road construction and specified road reconstruction may fluctuate when updated for the offering appraisal. Changes in logging costs and selling values can also have an undetermined effect on overall stumpage values; however, these changed values will not alter the order without modifying the alternative. Alternative 6 shows the highest relative net stumpage ($17.47/MBF), while Alternative 5 shows the lowest (-$22.53/MBF). Ketchikan Administrative Area combined administrative costs average approximately $35/MBF (TLMP 1991a, Appendix B). At mid-market values, all alternatives have a cost to prepare and administer, which exceeds estimated net value. At current rates, with predicted higher pond values, alternative 3 and/or 6 may be expected to have a net value which exceeds preparation and administration costs to the Forest Service.

SOCIO-ECONOMIC ENVIRONMENT

Key Terms

Cant - a log partially or wholly cut and destined for further processing
Discounted Benefits - the sum of all benefits derived from the Forest over the life of a project
Discounted Costs - the sum of all costs incurred from the Project Area during its period of implementation
Present Net Value - the difference between benefits and costs associated with the alternatives

Introduction

Ketchikan, Metlakatla, and Thorne Bay are the communities primarily affected by the North Revilla Project Area. Additionally, Hydaburg, Klawock, Meyers Chuck, Saxman, Tenakee Springs, and Wrangell were listed in the 1988 Tongass Resource Use Cooperative Study (TRUCS) as having subsistence activity within the Project Area.

The year-round economy of Southeast Alaska is largely dependent on the timber, recreation/tourism, and commercial fishing industries, which provide the majority of jobs. In the Ketchikan area, local residents earn their living through the forest products industry, the seafood harvesting and processing industry, and the recreation/tourism and supporting industries. Transportation, communication, and retail industries, educational, health and social services and four levels of government (municipal, borough, State, and Federal), also contribute to the local economy. Ketchikan's single largest employer is the Ketchikan Pulp Company (KPC). U.S. Borax (now Cominco Corporation) has constructed a base of operations at the Quartz Hill area of the Misty Fiords National Monument; however, mining is an inconsequential factor in the local economy at this time.

Employment and Income: Affected Environment

Timber Industry

Timber related employment is affected by technology and other factors that change over time. The employment multipliers used in this section represent past gains in efficiency. The employment and income estimates displayed in this section include the total effect throughout the economy associated with timber harvesting and processing. This total includes three separate components: direct effects, indirect effects, and induced effects. These components are defined as follows:

- **Direct Effects for Employment and Income** — Those that impact sectors either exporting processed wood products from the economic area or selling those products to final consumers. An example of direct employment would be people working in a sawmill.

- **Indirect Effects for Employment and Income** — Those that impact other production, trade, and service sectors that provide the production inputs needed to manufacture the processed wood products. An example of indirect employment would be people who manufacture the saw blades used in the sawmills.

- **Induced Effects for Employment and Income** — Those that impact consumer spending within the economic area associated with jobs that support the direct and indirect production. An example of induced employment would be grocery store employees who sell products to the people working in sawmill or making saw blades.

The timber industry affects the employment and income of people associated with timber harvest and processing

Timber Supply and Demand 1990 (USFS R10-MB-156) provides current timber harvest statistics for Southeast Alaska and the Tongass National Forest. This publication discusses the importance of Primary Manufacture laws, prohibiting most round log export from the Tongass, and the direct effects it has on employment in Southeast Alaska. Of the 1.09 billion board feet of timber harvested in Southeast Alaska in 1990, 43 percent was harvested from the Tongass National Forest, and 56 percent from private lands. However, approximately 93 percent of the timber harvested on private lands was exported in the round.

According to the *Alaska Industry Occupation Outlook to 1994*, "Wood processing in Alaska consists of two pulp mills, logging operations and sawmills and related employment centered primarily in Southeast Alaska. Total listed employment in 1989 was approximately 3,800 on an average monthly basis with the two pulp mills employing about 25 percent of (these) workers. Peak summer employment in 1989 was approximately 4,600."

Of those Statewide totals, within the Ketchikan Gateway Borough (KGB), the (Alaska) Department of Labor (1st and 2nd Quarter 1991 *Employment and Earnings Reports*) cites an average of 592 workers in the "Lumber and Wood Products" classification, with a high of 845 in August. Over that same period those workers averaged approximately $3,400 per month. In 1990, Lumber and Wood Products workers in the Ketchikan Gateway Borough had total earnings of approximately $38,110,000.

Within the KGB Paper & Allied Products classification, employment averaged 501 workers on a monthly basis, with a total 1990 earnings of $19,977,850. These two

classifications combined suggest approximately 1,090 full time jobs in the KGB, with an annual total earnings in excess of $58,000,000. While these figures provide definition to the scale of the value of the overall forest industry to the Ketchikan community, it is not fully representative since it does not show the earning of those within the local community who also benefit or derive income from the industry.

As 93 percent of Native Corporation harvested timber is exported, no adjustment is made to employment estimates attributable to National Forest System lands.

Employment and Income: Effects of the Alternatives

Timber Industry

Each alternative will affect the number and composition of timber-related employment within the communities of Ketchikan, Metlakatla, and Thorne Bay, since these are the primary processing sites of the long term contract holder, KPC.

In estimating employment impacts it is assumed that other supply and demand factors affecting markets for forest products and uses remain constant; however, assumptions lose validity as time frames are extended. For example, the amount of timber offered for sale within the Project Area is not the only factor that affects the number of wood product industry jobs. Other factors include the supply and demand for wood products and the subsequent number of employment opportunities, worker productivity, interest rates, import and export levels, production and shipping costs, competition, and other landowner harvest levels and policies.

Total timber-related employment is based on an estimated 8.67 total jobs per million board feet as developed by the computer simulation model IPASS (developed for the Forest Service to analysis the effects of agency management initiatives and investments on employment and earnings in Southeast Alaska). The total timber-related employment estimate is derived by multiplying 8.67 by the total timber volume harvested for each alternative, and includes direct, indirect and induced jobs as identified in this chapter.

Table 3-109 displays the multiplier applied for the volume estimated to be made available per alternative. It assumes that the entire volume will be offered in 4 years, with 9 percent the first year, 26 percent the second year, 27 percent the third, and 38 percent harvested the fourth or last year of harvest. Actual harvest may occur over a more extended time frame, and additionally can follow or occur during road construction.

Table 3-109
Projected Timber Related Employment by Alternative*

Proposed Harvest Year	Number of Jobs					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
1994	0	208	142	146	162	161
1995	0	602	411	421	468	466
1996	0	625	426	437	486	483
1997	0	880	600	615	685	680
Average Annual Number of Jobs	0	579	395	405	450	448

* includes ROW volume in addition to proposed harvest unit volume.
SOURCE: Somrak, 1993

Table 3-110 displays the estimated Yearly Earnings and Annual Average Earnings based on averages published in the Alaska Department of Labor, Research and Analysis, 1991 Employment and Earnings Summary Report, for the Ketchikan Gateway Borough. It also uses the same assumptions as Table 3-109.

Table 3-110
Estimated Timber Related Total Yearly Earnings by Alternative

Proposed Harvest Year	Yearly Earnings					
	Alt. 1 (M$)	Alt. 2 (M$)	Alt. 3 (M$)	Alt. 4 (M$)	Alt. 5 (M$)	Alt. 6 (M$)
1994	0	6,280	4,287	4,408	4,891	4,861
1995	0	18,176	12,409	12,711	14,130	14,069
1996	0	18,870	12,862	13,194	14,673	14,583
1997	0	26,569	18,115	18,568	20,681	20,530
Average Annual Earnings	0	17,481	11,926	12,228	13,586	13,526
Estimated Total Earnings*	0	69,895	47,673	48,881	54,375	54,043

* Includes Direct, Indirect, and Induced employment earnings.
SOURCE: Somrak, 1993

Alternative 1 proposes no timber harvest and could result in a decline in timber related employment should the mill not be able to substitute volume from another source. The effects of Alternative 1 are not predictable and could range from elimination of shifts to a partial or even a full short term shutdown, in addition to the potential loss of earning indentied in Table 3-110.

Any action alternative would contribute to meeting Forest Service/KPC Contract volume commitments and the retention of current employment levels. The no-action alternative could have short-term impacts as mentioned above, with possible long-term ramifications to the contract holder, the core communities and ultimately Southeast Alaska, through possible destablization of the wood products industry.

Long-term impacts on timber employment on the Ketchikan Administrative Area are a function of the Forest Plan, and the analysis in the TLMP Draft Revision (1991a) is incorporated by reference; however, the primary effect of any of the action alternatives would be maintenance of current employment levels.

Timber Value

For a detailed discussion on logging costs, pond log values, transportation and construction costs, refer to the Timber section of this chapter.

Table 3-111 displays a summary of the estimated value and costs of each alternative. Net values are rounded, since the figures are based on estimates.

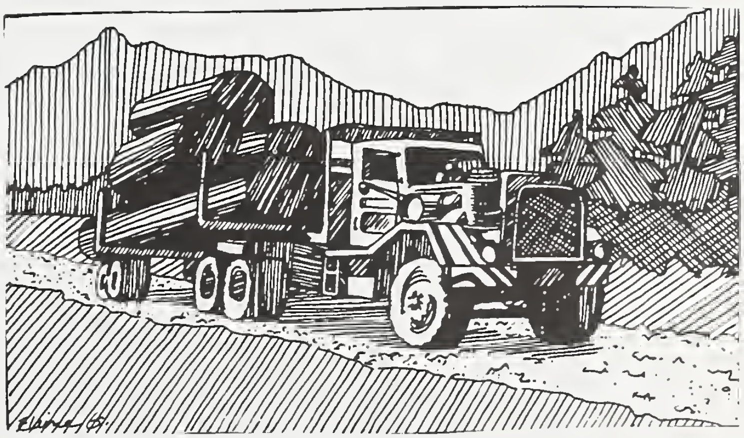


Table 3-111
Summary of Estimated Harvest Unit Stumpage Values, by Alternative, in Thousands of Dollars)

Alt.	Total Harvest Unit Volume (MMBF)*	Estimated Pond Value**	Estimated Transportn. Costs***	Estimated Constructn. Costs****	Total Est. Stumpage Value
1	0	$0	$0	$0	$0
2	251	$76,768	$52,117	$29,373	-$4,722
3	174	$53,032	$32,295	$17,946	$2,790
4	178	$54,384	$37,452	$17,756	-$824
5	193	$59,095	$38,615	$24,827	-$4,346
6	199	$61,008	$40,206	$17,327	$3,475

* rounded to the nearest million board feet
** values are meant for comparative purposes only
*** transportation costs include all costs not associated with capital investments or costs normally connected to road construction, such as: fall, buck, yard, sort, load, haul, dump, raft & tow
**** construction costs include costs associated with LTF development, road construction and reconstruction, such as: pit development, clearing, grubbing, embankment, haul, excavation, and related material, such as bulkheads, bridges and culverts
SOURCE: Somrak, Rhodes, Demmert & VanWeel/NET-4T, 1993

Employment and Income: Affected Environment

Commercial Fishing Industry

Harvesting and processing of fisheries resources provides a broad base of employment opportunities throughout Southeast Alaska. Many small towns and villages are very economically dependent on fish harvest and processing. The Ketchikan area supports diverse fish-based employment opportunities for bottom fish, herring, shell fish, salmon, and other specialty products. The fishing industry is highly seasonal. The potential for year-round employment is enhanced with the diversity of harvestable species, harvest methodology (troll, seine, longline, trawl, etc), and the processing methodology (frozen, canned, and the fresh market). Expansion of the bottom-fish sector provides the greatest opportunity for increased employment and more year round employment opportunities. (*Alaska Department of Labor, Research and Analysis(DL/R&A) 1990*)

Alaska Industry Occupation Outlook to 1994 states that most of the anticipated employment and growth within the food processing industry, "...will occur in the seafood processing sector...." Additionally, they indicate that more than half of those working within the industry were not residents of Alaska.

Employment related to the commercial salmon industry, attributable to the National Forest System lands, should not change in any of the alternatives.

The commercial fishing industry remains a major component of the Ketchikan Area economy along with the Forest Products industry. The State of Alaska Department of Labor, Research & Analysis, offers employment statistics within their *Quarterly Employment and Earnings Report's* for 1990. The industrial classifications of manufacturing (canneries), transportation, commercial and utilities (cold storage), and wholesale trade (fish buyers), supported on the average approximately 560 workers within the KGB, and annual salaries of approximately 10 million dollars. These State figures do not include self-employed fishermen, or their non-covered (state unemployment insurance) employees, or the value of their catch. The Greater Ketchikan Chamber of Commerce reported that for 1990 the fishing industry is valued locally at $90 million annually and provided over 1,500 jobs within the community (residents and nonresidents) in 1990.

The TLMP Revision (1991a) analyses employment associated to regional fish habitat capability based on annual commercial salmon. Estimates for the Ketchikan Administrative Area of the Tongass National Forest predict the capability to provide 21,109,000 pounds of annual commercial salmon harvest. Approximately 875 jobs are generated by the commercial fishing from National Forest land.

Neets Bay Fish Hatchery–Southern Southeast Regional Aquaculture Association (SSRAA)

Commercial fishing (charter operators, hand and power trollers, gillnetters, seiners etc.) and cannery employment are the common examples of benefits of the fisheries resource. An example of fisheries resource development within the North Revilla Project Area is the Neets Bay Fish Hatchery, which is operated by Southern Southeast Regional Aquaculture Association, (SSRAA) and uses National Forest System land under the approval of a special use permit. Annual fees paid to the Federal Government for use of the site are based on two percent of the facility's value. For

1991 these fees were $9,960; for 1992, $10,018 and for 1993, $10,141. SSRAA provides direct and indirect benefits through permits fees, hatchery employment, and hatchery fish harvest opportunities.

The SSRAA organization is headquartered in Ketchikan, with operations throughout southern Southeast Alaska. The Neets Bay facility employs and houses six full-time employees and 25 seasonal employees. Salaries totaled approximately $206,000 for permanent employees, and $53,000 for seasonals in 1992. Overall budget for the Neets facility was over $680,000, with over half of that directly benefiting the local economy.

Additional quantifiable benefits provided by the Neets facility include the commercial value of returns to the troll, seine, and gillnet gear groups, for coho, chinook, and chum, which averaged $2,004,984 from 1985 thru 1990. The commercial value of 1991 returns was $1,837,605. Additionally, SSRAA harvested $1,060,500 worth of returning spawners at Neets Bay, in support of their operations. The value of benefits to commercial charter operators currently cannot be quantified.

SSRAA also releases sockeye salmon in Shrimp Bay from the Beaver Falls Hatchery for cost recovery purposes.

Employment and Income: Effects of the Alternatives

Commercial Fishing Industry

Current standards and guidelines, and management area prescriptions are expected to limit measurable effects on fish during timber harvest and related activities. There are no substantive changes in commercial fish habitat capability predicted. The direct and indirect jobs attributable to National Forest System Lands for the commercial salmon industry should also remain unchanged for all alternatives.

Neets Bay Fish Hatchery (SSRAA)

No substantive effects have been predicted due to timber harvest on the water resources supplying the Neets Bay Fish Hatchery. Should harvest in the Neets Bay area occur, and a road connection to a LTF in Shrimp Bay be constructed, access to SSRAA Shrimp Bay activities could be enhanced. Alternatives 2, 4 & 5 include timber harvest in the Neets Bay area and would provide a road connection to the LTF at Shrimp Bay.

Employment and Income: Affected Environment

Recreation and Tourism

During the 1980's, the tourism industry became a major force in the economics of Southeast Alaska. Cruise ships traveled the Inside Passage making regular stops at Southeast Alaska ports in record numbers. Newer and larger capacity ships as well as smaller ships tapping special interests are ushering a new era of tourism to Southeast ports. The visitor season currently runs from May through September.

In 1992, six of the ships visiting the community of Ketchikan carried more than 1,000 passengers, and six carried 90 or fewer passengers, with a total of 23 different ships

and more than 360 stops. The 1993 schedule calls for ten ships carrying more than 1,000 people and seven carrying 90 or fewer, with more than 420 stops and more than 320,000 passengers. According to the *Ketchikan Visitors Study* (1991), each of these visitors spends an average of $67 during a visit to Ketchikan. The economic impact of this industry is likely to increase, with at least two additional ships carrying more than 1,000 passengers each, identified for the 1994 season. Table 3-112 displays some of these growth patterns from 1981 through 1993 with Ketchikan Visitor Bureau's Cruise Ship Data.

Table 3-112
Recreation And Tourism Indicators for the Community of Ketchikan

Year	Cruise Ship Passenger Numbers *1	Cruise Ship # of Ships/ # of Stops *1	Scenic Flight Passengers Misty Fiord *2
1981	85,000	12/142	6,300
1982	85,000	11/142	5,200
1983	96,782	12/156	5,300
1984	96,705	13/157	7,000
1985	145,646	18/224	12,000
1986	182,400	25/289	11,900
1987	202,000	23/315	12,200
1988	209,519	26/355	8,500
1989	197,790	18/267	8,100
1990	236,325	23/314	NA
1991	242,755	27/362	NA
1992	263,046	23/364	NA
1993	321,780	28/421	NA

*1 From Ketchikan Visitors Bureau *2 From Misty Fiords National Monument

Marketing studies by the Alaska Division of Tourism indicate that scenery, forest, mountains, out-of-doors and wilderness (unspoiled, rugged) were the top interests appealing to potential nonresident visitors (Bright 1985). While these interests account for nonresident increases, resident recreation also increased during the 1980's, as indicated by increased fishing and hunting license sales. Resident recreation needs are different and more varied than the non-resident but include a high demand for roaded recreation opportunities.

The tourism and recreation industry is not a single industry, but a composite of many industries serving more than visitors. For example, retail trade, service, and transportation industries serve both visitors and residents. The labor force employment associated with tourism and recreation are different from manufacturing industries because employment tends to be highly seasonal and low paying.

Visitor accommodations and recreational expenditures by visitors to Southeast Alaska directly supported an average of 2,480 jobs during the 1980's, with a high in 1987 of 2,800 jobs. Indirect employment within this category, averaged 1,030 jobs during the same period, with a high in 1988 of 1,150 jobs. During the 1980's, recreation and tourism generated about 25 percent of the jobs directly and indirectly supported

within the region by the major industries of Southeast Alaska, including timber, commercial fishing, and mining TLMP Revision (1991a).

Sport Fishing

The *Southeast Alaska Sport Fishing Economic Study* (1991), a research report done for the State of Alaska, contains Ketchikan Area data:

"In 1988, anglers spent $83.1 million for sport fishing in Southeast Alaska. Resident anglers spent about $40.7 million and nonresident anglers spent about $42.4 million."

Ketchikan area resident anglers spent about $6.6 million on sport fishing. "For nonresident anglers, sport fishing in the Ketchikan area generated the most spending, comprising about $13.7 million, or 32 percent of all nonresident angler spending" (in Southeast Alaska).

Sport fishing by both resident and nonresident anglers is a major source of revenue for Alaska.

Of all species sought by residents and nonresidents, king salmon generated the most spending, accounting for $13.3 million, or about 32 percent of all resident angler spending, and accounting for $9.6 million, or 23 percent of all nonresident spending. This has important significance for the local charter fleet.

According to the *1992 Southeast/Yakutat Chinook Management Report for Marine Sport Fisheries* (Dec.1992), the Ketchikan Area had 64 registered charter vessels in 1988, but 199 in 1992. The charter fleet has grown over 310 percent since 1988, which would indicate a substantial increase in the above cited dollar amounts recorded for 1988, and an increased importance within the local economy.

The information is not specific enough to break it out among the core communities and the Project Area; however, the Neets Bay hatchery contributes substantially to the sport take on the "north end" of the Ketchikan Administrative Area. (Personal Communication; Amend, 1992.)

Figures 3-26–3-28 provide a breakdown of the dollars spent for sport fishing in Southeast Alaska in 1988.

Figure 3-26
Sport Fishing Expenditures in Southeast Alaska for Residents and Nonresidents

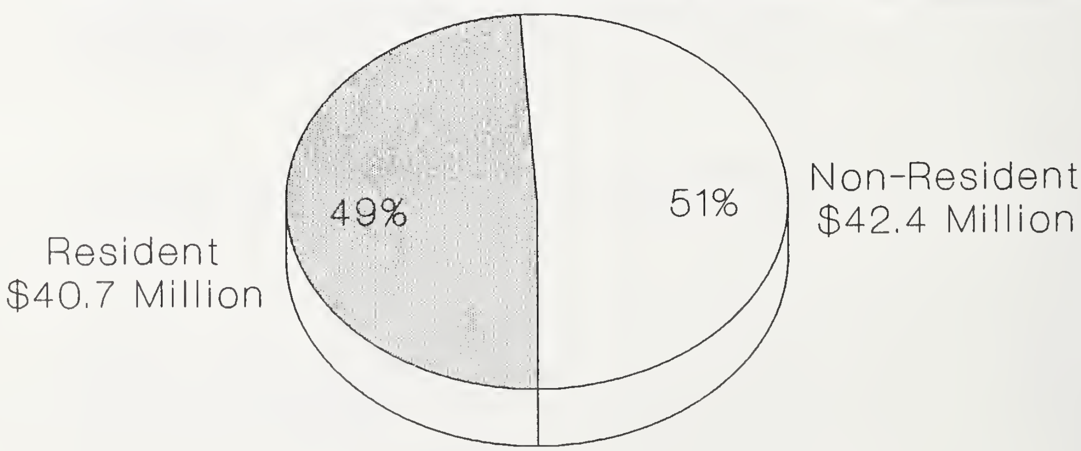
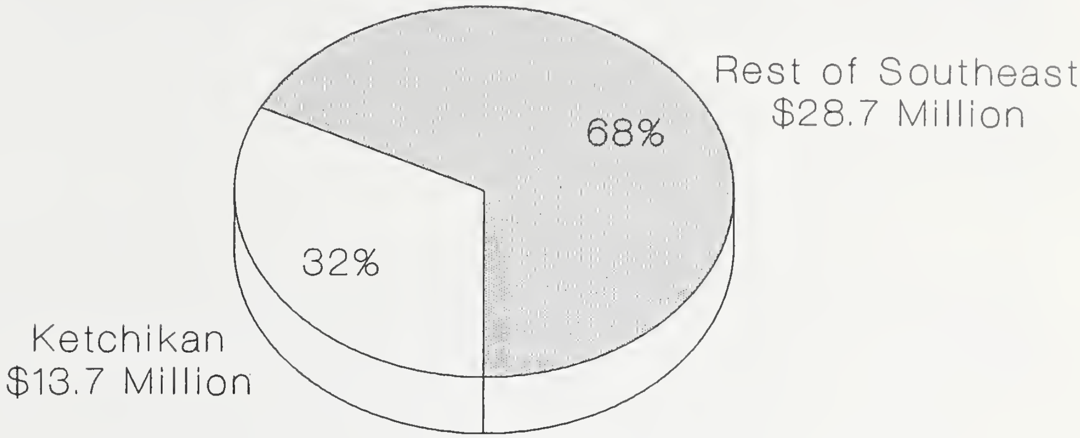
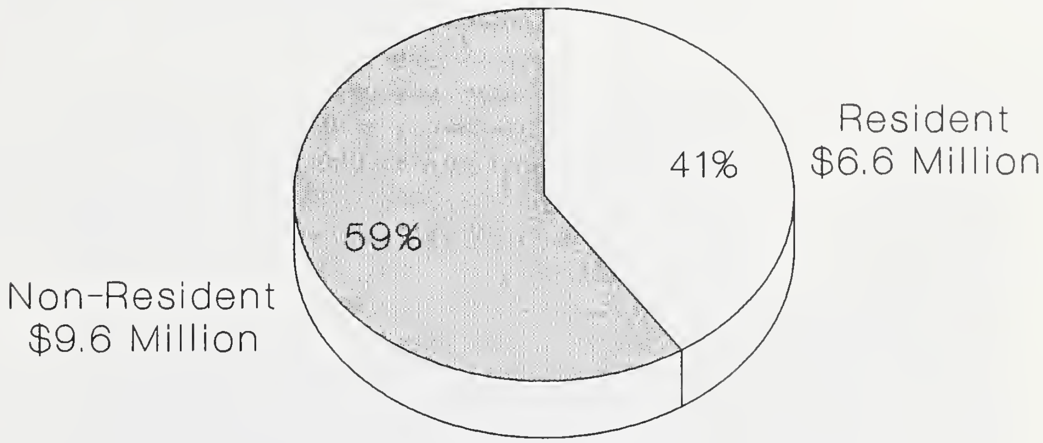


Figure 3-27
Sport Fishing Expenditures in Southeast Alaska by Nonresidents



A total of $42.4 million was spent for sportfishing in Southeast Alaska in 1988.

Figure 3-28
1988 Expenditures for King Salmon Fishing in the Ketchikan Area



A total of $16.2 million was spent on king salmon fishing in Ketchikan in 1988. Between 1988 and 1992 the Charter Fleet grew over 310% indicating in a potentially similar increase in revenue.

It was estimated that angler spending in 1988 contributed toward the generation of $1.5 million in local sales tax revenue, $105,000 in lodging tax, $135,000 in state corporate income tax and $1.2 million in fishing license revenues. For nonresident anglers, fisheries in the Ketchikan area are the most valued throughout Southeast Alaska, with an annual "willingness-to-pay" value of $7.5 million.

Wildlife dependent tourism is a major source of revenue to Alaska, with both consumptive and nonconsumptive use of major importance to Southeast Alaska.

Sport Hunting

Sport hunting within the Project Area and the area adjacent to the core community of Ketchikan focuses on two big game species, black bear and Sitka black-tailed deer. There are no big game outfitter/guides with current permits or waivers operating within the North Revilla Project Area; however, the pursuit of these two species by resident and nonresident hunters contributes to the local economy. The primary big game species in Southeast Alaska and the Ketchikan Area, in terms of number harvested and hunter participation, is Sitka black-tailed deer. Deer constitute over 90 percent of the total big game harvest in Southeast Alaska (Doerr & Sigman 1986). Value can be established using the willingless-to-pay concept, which can be described as a value which approximates market price. The willingness-to pay concept values resident deer hunting in Southeast Alaska the highest at $331. (Swanson, Thomas & Donnelly,1989). Hunting expenditures are not available for the Ketchikan area.

Economic Value of Big Game Hunting in Southeast Alaska RM-16(1989) provides area and local data. Expenditures for sport hunting are divided into transportation/on-site costs and equipment costs. Transportation and on-site costs include boat, airplane, ferry, auto, restaurant, lodging, license fees, and other site costs. Equipment costs include firearms, camping gear, maps, and other pre-hunt expenditures that are usually made at the individual's residence or origin. These two categories provide an estimate to where expenses occur and, therefore, how many dollars are generated at the hunt site and the hunter's origin location. This information is important to show how much new money is being brought into the economy. (New money has a greater effect than the re-circulation of money already within a community.)

In Southeast Alaska, resident expenditures were fairly evenly divided between transportation costs and equipment costs. Transportation costs were the highest for mountain goat hunters, with an average expenditure of $577, and the lowest, $259, was by deer hunters. Nonresident hunters spent significantly more on transportation/on-site costs than they spent on equipment costs; for transportation costs the highest average expenditure, $1,926, was by moose hunters, with $1,050 spent by deer hunters.

For the purpose of this sport hunting analysis, information was derived from data developed for Major Harvest Areas (MHA) 1,4,5,6 (the Ketchikan Administrative Area) and data for MHA 5 which comprises the Project Area. This data potentially underestimates the total value to the Ketchikan area, as it serves as a transportation hub servicing the more remote areas of southern Southeast Alaska. State of Alaska 1991 Deer Hunter Survey Preliminary statistics (4/7/92) suggest that 1,239 resident hunters, 56 non-local resident hunters, and 2 nonresident hunters sought deer in the Ketchikan area, during the 1991 season. Resident equipment costs would be approximately $641,150. Transportation and on-site expenses could account for an additional $335,400. Nonresidents would have spent approximately $2,100 on transportation/on-site costs. State 1991 data indicates no nonresidents and only about 240 residents chose to seek deer in the Project Area. Total willingness-to-pay amount for deer hunting for the Ketchikan Area is approximately $429,000.

Nonconsumptive Use

The Ketchikan Administrative Area USFS, Fiscal Year 1991 Timber Sale Program Information Reporting System (TSPIRS) identifies nonconsumptive use of wildlife in the Ketchikan Administrative Area as important, but difficult to quantify. Additional roads make wildlife viewing easier, but in the minds of many of the wildlife viewers the quality of the natural experience decreases. "Finally, the number of roaded and unroaded locales in the Ketchikan Administrative Area available for nonconsumptive users, indicate that nonconsumptive availability may exceed demand. Therefore, the net change in nonconsumptive values is minimal compared to changes in consumptive values". (TSPIRS)

While tourism is projected to continue to grow at a slow, but steady rate over the next ten years (Hill, 1991), growth in the adventure travel segment of the tourism industry is expected to grow rapidly (Data Decisions Group, 1989). These adventure, or "independent" travelers tend to use the services of outfitters and guides, stay in lodges or camp, and plan their own itineraries. Wildlife viewing and photography are some of the most popular activities among these Forest visitors.

A survey of businesses which provide products and services for wildlife viewing, wildlife photography and other nonconsumptive wildlife uses indicated that this use is rapidly increasing in Southeast Alaska (Shea, 1990). It is estimated that over 200 businesses in Southeast Alaska provide wildlife viewing recreation services. This business activity is growing as much as 33 percent annually, with client expenditures contributing to the substantially to the economy (Shea, 1990).

The demand for independent travel within and around the Project Area is evidenced by the five lodges and resorts: Bell Island Resort, Yes Bay Lodge, Clover Pass Resort, Salmon Falls Resort, and Silver Bright Lodge. In addition, there are two permitted kayak guides operating within the Project Area and one air charter with service for tourists to the SSRAA Neets Bay hatchery, providing nonconsumptive wildlife opportunities for clients.

Tourism is projected to continue to grow over the next 10 years with photography as a popular activity.

Employment and Income: Effects of the Alternatives

Recreation and Tourism

Projections for future employment for Southeast Alaska in the recreation and tourism industries, including employment related to sport hunting and fishing, are a 27 percent increase in use for recreation and tourism, 36 percent for sport fishing, and 53 percent for hunting related jobs during the 1990's (TLMP-DEIS, USFS R10-MB-96). The core community of Ketchikan should on the average reflect these increases. Differences between action alternatives should have little overall impact on these projections.

Because there is minimal use of the Project Area by large cruise ship and/or the Alaska Marine Highway ferries, and because the proposed alternatives will have minimal if any effect on the recreation places (see the Visual Resources section, this Chapter), no significant impact is expected on this sector of the recreation/tourism industry.

The action alternatives will have no measurable effects on the sport fishing jobs. The action alternatives are expected to have no measurable effects on jobs generated by the permits for the kayak or air charter service because of standards and guidelines for the visual and soils resources. There are no other outfitter/guides with current permits or waivers operating within the North Revilla Project Area. Access to the area (by plane or boat) will be unchanged, therefore minimizing changes to the economic effect of sport hunting (also see Nonconsumptive Use this section below).

Nonconsumptive Use

Nonconsumptive use is limited to those effects on access by boats or float planes to the Project Area. Access to the Project Area will not change; however there will be visual and recreation setting effects that change by alternative. These effects are documented in the Recreation, Visual Resources, and Roads and Facilities sections of this chapter.

Of the action alternatives, Alternative 2 harvests the most seen acreage and may create the greatest visual impact to the nonconsumptive user. Alternative 5 harvests the least seen acreage and could have the least amount of visual impact. Table 3-113 summarizes each alternative in its amount of visual disturbance observable to the nonconsumptive user.

Table 3-113
Summary of Estimated Acreage of Harvest Unit Visual Disturbance by Alternative

Alt. #	Estimated Total Volume (MMBF)*	Estimated Seen Acreage	Number of Harvest Units Seen **
1	0	0	0
2	251	4,005	119
3	174	3,063	80
4	178	3,546	88
5	193	2,725	109
6	199	3,568	91

SOURCE: Somrak, GIS, 1993
* rounded to the nearest million board feet.
** as seen from selected saltwater viewpoints, see Visual Resources Section this chapter.

While the number of roaded and unroaded locales within the project area will have proportional variations, the amounts of both type locales remaining after implementation of any action alternative will still meet the needs of many users. It is assumed that (year-to-year) the net effect to nonconsumptive users is unquantifiable, however they will likely be affected during timber harvest activities. As the setting changes over time, users will either adapt, be displaced, or substitute their leisure activities.

Net Cash Flow and Payments to State: Affected Environment

A percentage of all monies received (including purchaser road credits) from the Ketchikan Administrative Area is paid to the State of Alaska. National Forest (timber) Receipt payments to the State of Alaska are based on a 25 percent formula for use of the Tongass National Forest System land and resources that generate income for the Federal government. Ninety-nine percent of the payments to the State from Federal receipts are generated from timber sales and are then dispersed for use on public schools and public roads. Table 3-114 shows the total receipts from the Tongass National Forest Receipt program, subsequent payments to the State of Alaska, and a summary of dispersements to the Ketchikan Gateway Borough (KGB).

Table 3-114
Tongass National Forest Receipts And Payments, Fiscal Years 1980-1992

Fiscal Year	Receipts*	Payments to Alaska	Dispersed to KGB***
1980	26,024,494	6,506,124	N/A
1981	15,007,944	3,751,986	N/A
1982	21,622,764	5,405,691	N/A
1983	5,365,915	1,341,479	N/A
1984	4,063,189	1,015,797	N/A
1985	209,231	52,308	2,329.79
1986	1,967,240	491,810	21,940.58
1987**	-2,033,575	---	---
1988	1,232,672	308,168	13,764.52
1989	20,183,133	5,045,783	225,386.78
1990	35,544,272	8,886,068	402,242.91
1991	36,968,718	9,242,180	412,333.90
1992	13,093,312	3,273,328	146,123.34

SOURCE: ANILCA 706(a) Draft 1988 Supply and Demand Report Number 8, 1990 Timber Sale Program Information Reporting System (TSPIRS), KGB Dept. of Revenue, Feige, Somrak.
* Capital investments such as permanent roads, bridges, log transfer facilities (LTF'S), and timber stand improvements also contribute to the total assets of the Tongass National Forest, reduce future management costs, and are scheduled to achieve management objectives described in the Tongass Land Management Plan.
** Tongass receipts for fiscal year 1987 were negative as a result of Comptroller General Decision B-224730 of March 31, 1987 to retroactively implement the emergency rate redeterminations for short-term sales. Without the reduction, Tongass receipts would have been positive by $2,139,943. As a result of the negative receipt, no payments to the State were made in 1987.
*** Provided by the KGB, Dept. of Revenue. The KGB share of National Forest Receipt funds for 1993 is projected by the borough to be $300,000.

Net Cash Flow and Payments to State: Effects of the Alternatives

When National Forest Receipt Act payments change, the borough must compensate with other sources of revenues to maintain the same quality and quantity of school and road programs. These monies are not always at a stable level and are not 100 percent predictable for use in the budgeting process for the KGB. Fluctuations have occurred in the past.

When National Forest Receipt Act payments are decreased or eliminated, dollars immediately available decline for borough school and road programs, and funding for other programs which are of lower priority to the borough also begin to decline.

Tables 3-115 and 11116 display the estimated volume harvested, anticipated total timber receipts (including Purchaser Credits for road construction), as well as estimated returns to the state and borough, and total estimated net revenue to the

United States government. These estimated returns could be spread out over a three to seven year period depending on the rate of harvest.

Table 3-115
Estimated Returns to State of Alaska and Ketchikan Greater Borough

Alternative	Estimated Total Volume (MMBF)*	Estimated Total Receipts (M$)**	Estimated Returns to State (M$)***	Estimated Returns to Ketchikan (M$)***
1	0	0	0	0
2	251	23,875	5,969	269
3	174	20,192	5,048	227
4	178	16,375	4,094	184
5	193	19,902	4,975	224
6	199	20,182	5,046	227

SOURCE: Somrak, Nightingale, 1993
* rounded to the nearest million board feet.
** based on mid-market rates, timber receipts, and purchaser credits for road construction.
*** for/from this action only.

Table 3-116
Estimated Fiscal Effects of the North Revilla Project

Alternative	Estimated Total Volume (MMBF)*	Estimated Stumpage (M$)**	Estimated Administrative Costs (M$)***	Estimated Net Revenue (M$)***
1	0	0	1,923	(-1,923)
2	251	(-4,722)	8,771	(-13,493)
3	174	2,790	6,095	(-3,305)
4	177	(-824)	6,225	(-7,049)
5	193	(-4,346)	6,750	(-11,096)
6	199	3,475	6,948	(-3,473)

SOURCE: Somrak, Nightingale, 1993
* rounded to the nearest million board feet.
** based on mid-market & Net4T analysis, Rhodes/Demmert/VanWeel, 1993
*** for/from this action only, based on TLMP KTN Area Ave. of $35/MBF

Economic Efficiency: Affected Environment

The National Forest Management Act of 1976 (NFMA) set requirements for economic efficiency of Forest management proposals. Although the Forest Service has generally tried to achieve cost-effective management (lowest possible input cost per unit of

output), systematic evaluation of all costs and benefits from practices and activities has been undertaken only in recent years.

The measure of economic efficiency applied in formulating and evaluating alternatives is Public Net Benefits (36 CFR 219.1(a) and 219.12(f)). Public Net Benefits (NPB) are the sum of Present Net Value (PNV) and non-priced commodity values (non-priced benefits (NPB).

- PNV is the difference between the discounted value of all outputs to which monetary values or established prices are assigned and the total discounted costs of managing the area.

- Examples of nonpriced benefits include scenic quality, wildlife habitat, and community stability. Values of some non-priced commodities are inferred from observations of indications such as the number of participants, tolerance of congestion, expense of participation in Forest activities and the value of community stability. Respondents to the DEIS appear to value community stability above all other NPB's.

The dominant nonpriced commodities for the project are represented by the public issues. One function of the public involvement process, which contributed to the project issues, was the inference of nonpriced commodity values. Since the inferred demand for nonpriced commodities is subjective, a range of production of priced and nonpriced commodities is provided by the alternatives considered.

The nonpriced benefits of the action alternatives are all assumed to provide benefits which exceed the PNV (Table 3-100) or the Estimated Net Revenue to the government (Table 3-116), in Community Stability factors such as direct/indirect/induced employment earnings (Table 3-110), payments to the State (Table 3-115), and tax revenues.

Returns to U.S. Treasury

The Timber Sale Program Information Reporting System (TSPIRS) shows the Tongass National Forest as a whole has made a profit, before payments to the State of Alaska, in three of the past four years. Table 3-117 summarizes this information.

Table 3-117
TSPIRS Report 1 for Tongass NF as a Whole

	FY 1989	FY 1990	FY 1991	FY 1992
Harvest (MMBF)	444.6	470.7	363.7	369.7
Revenues*	$22,539	$29,812	$29,632	$11,489
Expenses*	$13,852	$16,239	$16,527	$21,629
Net Revenue*	$ 8,687	$13,573	$13,105	-10,140

* in thousands of dollars

Economic Efficiency: Effects of the Alternatives

Table 3-118 summarizes the changes in present net value among alternatives and between the DEIS and the FEIS. The alternatives are ranked in order of descending present net value. This figure represents the economic efficiency of each alternative, or the difference between benefits and costs associated with the alternatives. (Each alternative has a specific management strategy or emphasis which requires certain timber harvest levels that may not be the most economically efficient solution for the Project Area.)

The differences in the PNV between Draft and Final EIS are due to changes addressing concerns identified following public review of the DEIS. These differences also reflect the increases in the Transportation and Construction cost factors, while Pond Log values remained the same between the Draft and Final, see Silviculture and Timber section of this chapter.

Table 3-118
Present Net Value (PNV) Comparison of Alternatives (in dollars)

Alternative Number	DEIS Present Net Value	FEIS Present Net Value	Difference between Draft & Final
1	-$1,923,077	-$1,923,077	$0
3	-$582,176	-$3,112,112	$2,529,936
6	$928,634	-$3,284,145	$4,212,774
4	-$2,276,847	-$6,437,682	$4,160,835
5	-$6,248,575	-$10,086,274	$3,837,699
2	-$4,870,057	-$12,288,451	$7,418,394

SOURCE: Somrak, Arrasmith, 1992, 1993

Historically the timber market has been cyclic, with sharp peaks and valleys in pond log value. A $20/MBF change in market price can mean as much as a 100 MMBF swing in the ability of the Project Area to provide an economic supply. (TLMP, SDEIS, Appendix B) Therefore, the PNV yardstick as it relates to the timber revenue component is subject to large fluctuation from year to year.

Returns to U.S. Treasury

A TSPIRS-type assessment for the North Revilla FEIS was considered but not implemented. TSPIRS was designed to be analyzed on an annual basis at the National Forest level for the entire timber program, with the expenses and costs amortized over the length of the rotation (100 years). This is particularly hard to do on a project-by-project basis, especially for roads. In addition, TSPIRS counts all of the expenses associated with a timber sale, including the NEPA prep work, inventories, etc. These expenses are put into a sale or growth activity pool, and a percentage is charged off each year based on how much volume is harvested and how much is

remaining under contract. Allocating this annual expense is very difficult to do on a project-by-project basis.

Timber Demand Analysis: Affected Environment and Effects of the Alternatives

Ketchikan area wood products are traded in the Pacific Rim Market. Over 90 percent of wood product produced in Alaska is exported. Solid wood products (logs, cants and lumber) are shipped to Japan, Korea, The Peoples Republic of China, Taiwan, and Canada. The dissolving pulp produced from the hemlock and lower grade spruce logs is shipped to a wider array of countries. For example, in 1988, pulp products were shipped from Alaska to Argentina, Austria, Bangladesh, Belgium, Bulgaria, China, Egypt, France, West Germany, India, Indonesia, Iraq, Japan and six other foreign countries. Approximately 15 percent of the dissolving pulp produced in Alaska is shipped to destinations in the continental United States. The Pacific Rim demand for wood products far exceeds the productive capability of the Ketchikan Area. The Ketchikan Area is a very small supplier in a very large market. It is anticipated that the Pacific Rim market will be able to purchase all the wood products which can be supplied at a cost lower than export value.

Lifestyles and Communities: Affected Environment

The lifestyles, values, and economic pursuits of Southeast Alaska residents are highly diverse. Many people live in the region because of the opportunity to participate in resource-development occupations; others desire the lifestyles afforded by remote, uncrowded living situations, and the chance to be close to their family and friendship networks. Other people choose to remain in Alaska because of the hunting and fishing opportunities and the chance to live in close proximity to a wilderness environment. Many Alaska Native residents remain attached to Southeast Alaska because it provides the context of their cultural heritage. This diversity of attitudes, values, and lifestyles suggests that the proposed timber harvest and road construction will affect people in different ways. Many of these lifestyle choices, values, and economic opportunities are closely tied to the Tongass National Forest, so management of the Forest has widespread implications to a community. They are affected by changes in environmental quality and benefit from opportunities for free and abundant resources and products from the National Forest, including firewood, wildlife and fish. The preservation of these National Forest assets is of great importance to these communities.

Lifestyles and Communities: Effects of the Alternatives

While the implementation of any alternative will affect changes in employment and income, each will also have effects on the other social values of individual lifestyle and community stability. The nature and extent of proposed actions, and the Project Area, are as diverse as the range of lifestyles within the affected communities. Areas for the individual pursuit of chosen lifestyle are available in the Project Area, even if not in the entirety of the Project Area. For additional development of lifestyle effects, see the Subsistence section of this chapter.

Four social groups within the Tongass National Forest have been identified as likely to be affected by the management direction expressed by the alternatives. These groups are not mutually exclusive; a person may belong to more than one group. These groups include: (1) people who participate in resource development occupations, (2) others who desire the lifestyle afforded by remote, uncrowded living, (3) people who choose to live in Alaska because of hunting and fishing opportunities, (4) Alaska Natives, and (5) tourists. People within each social group have different lifestyles, different attitudes, beliefs, and values; these variables can be used to measure social effects for the alternatives upon these groups. Components of social organization (the way society is organized, including institutions, community cohesion, community stability) are also variables to be considered for each social group.

People in the Ketchikan community who participate in resource development occupations will find that Alternative 1 may conflict with their attitudes, beliefs, and values, and could result in extreme disruption of community stability and cohesion. On the other hand, Alaska Natives, tourists and those who desire a remote, uncrowded lifestyle, with high quality hunting and fishing opportunities, will find that Alternative 1 highly supports their lifestyles, attitudes, beliefs, and values, and provides slight disruption of the stability and cohesion of their communities.

Those who participate in resource development occupations will find that Alternatives 2, 3, 4, 5 and 6 support their lifestyles and moderately coincide with their attitudes, beliefs, and values. These alternatives will provide a moderate level of timber harvest and thus will provide support of the lifestyles in timber communities. Reserving suitable timber acres for stream buffers and scenic viewsheds does not coincide with the values of these people and will only moderately support their attitudes and beliefs. The protection of visual quality from every viewshed, the protection of water quality and minimizing effects upon recreation places in all alternatives coincide with the attitudes, beliefs and values of tourists and people who desire high quality fishing opportunities. The general reductions in wildlife habitat capability will moderately affect the lifestyles, attitudes, beliefs, and values of Alaska Natives and those who desire high quality hunting opportunities. There will be no disruption of community stability and cohesion if these alternatives are implemented.

Cumulative Effects

The cumulative effects of each of the alternatives on the economic and social environment are quite difficult to estimate. There are a wide variety of factors affecting the employment, income, receipts, population, lifestyle, and community stability of Southeast Alaska. While it is not easy to project the incremental effects of the proposed actions on the Project Area based on proposed and reasonably foreaeesble actions attributable to the KPC contract, there are two facets of long-term timber harvest in the Project Area that can be addressed.

The first facet relates to the economic and social benefit of continuing to meet the contractual requirements of the KPC contract and offering adequate timber volume to meet the timber demands in order to maintain KPC operations at a stable level. From the standpoint of employment, personal income, population, community services, and community stability, there is substantial benefit to maintaining long-term timber harvest. The receipts generated, including revenue to the U.S. Treasury, payments to the State of Alaska, taxes, and dollars brought into the community, all represent an economic benefit of continued timber harvest activity. The TLMP Revision (1991a) schedules areas for long-term timber harvest activity. The North Revilla Project Area is one of the areas scheduled to meet these economic and social needs.

The second facet of a long-term timber harvest that can be addressed is the alteration of the natural environment that takes place when roads are constructed and timber harvested. Some of the economic and social value of Southeast Alaska is dependent on its natural setting. The recreation and tourism industry is based primarily on the natural conditions and scenic quality. From the TLMP, Supplement to the Draft Revision, Table 3-261, it could be interpreted that 25 to 30 percent of Southeast Alaska jobs are based on elements of the natural condition and visual resource, which would come third after timber and commercial fishing resource development. As more and more acres of National Forest System Lands and other lands are converted from a natural condition to a managed forest, the activities dependent on and the values attributed to the natural state of the forested land will be affected.

The balance necessary to maintain a viable or even robust economic and social environment is set at a National Forest level, not at a project level. Based on regional standards and guidelines, the action alternatives have been constructed to minimize the negative cumulative effects on the economics and community values of the core communities when considering the total resource.

SUBSISTENCE

Key Terms

Alaska National Interest Lands Conservation Act (ANILCA) - requires evaluations of subsistence impacts before changing the use of certain Federal lands
Non-rural - a generally a community with more than 7,000 people; doesn't qualify for priority use of subsistence resources
Rural - any area of Alaska determined by the Federal Subsistence Board to qualify as such; qualifies for priority use of subsistence resources
Subsistence - customary and traditional uses by rural Alaskans of wild renewable resources
Wildlife Analysis Area (WAA) - a division of land designated by Alaska Department of Fish and Game and used by the USDA Forest Service for wildlife analysis

Many Southeast communities use natural resources as a base or supplement to their livelihoods. Nearly a third of rural households in Southeast Alaska get at least half their meat and fish by hunting and fishing (Holleman and Kruse 1991). Fish and game are widely preferred sources of food among Southeast households, regardless of their incomes. Examples of major subsistence resources include deer, salmon, halibut, trout, harbor seal, crab, clams, waterfowl, and berries. Findings from the TRUCS indicate that "members of the highest income group have the highest mean harvest and the lowest mean percent of meat derived from subsistence activities" (Kruse and Muth 1990).

Subsistence activities represent a major focus of life for rural residents. These resource or subsistence gathering activities include hunting for deer, bear, marine mammals, and birds; digging clams, catching fish and shellfish (crabs, shrimp); harvesting marine invertebrates; trapping furbearers; collecting firewood; collecting herring eggs; and collecting berries and edible plants and roots. Subsistence goods may be eaten, traded, given away, or made into an item of use or decoration. For example, the fur from the marten or sea otter may be used for regalia costumes which are used in ceremony and dance.

Even for households which can afford to purchase all their their own food, the act of gathering subsistence resources is an important cultural aspect reflecting deeply held attitudes, values, and beliefs. Some traditional foods are not available through any other means than subsistence, and often, the occasions for gathering wild foods and edible plants are social events. Historical patterns of movement such as the annual cycle of dispersal into small family groups at summer fishing camps and then to larger gatherings at protected winter villages are also linked to the tradition of subsistence gathering.

Average per capita income may or may not indicate the importance of subsistence to a community. While individuals of low income may have a greater dependence on

subsistence gathering, individuals with a higher income may simply be in a position to have a more comfortable lifestyle because they combine their subsistence activities with their ability to purchase goods. Higher income does not deter an individual from gathering resources and sharing those with friends and family (Kruse and Muth 1990).

Sharing of subsistence resources is important not only between households within communities, but also with extended families and friends in other areas. This includes sharing with those households which are unable to participate in the harvest of resources. And because some communities have access to resources not found in other communities, sharing of subsistence resources occurs between as well as within communities.

The importance of subsistence is recognized in both State and Federal laws. With the passage of the Alaska National Interest Lands Conservation Act (ANILCA), Congress recognized the importance of subsistence resource gathering to the rural communities of Alaska. ANILCA (16 USC 3113) defines subsistence as:

> "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or sharing for personal or family consumption; and for customary trade."

ANILCA finds and declares that "the continuation of the opportunity for subsistence uses by rural residents of Alaska, including both Natives and non-Natives, on public lands." It also declared that "consistent with sound management principles, and the conservation of health populations of fish and wildlife, the utilization of the public lands in Alaska is to cause the least adverse impact possible on rural residents who depend upon subsistence uses of the resources of such lands."

Effective July 1, 1990, the Federal government became responsible for the management of ANICLA Title VIII subsistence use of fish and wildlife resources on Federal public lands. Regulated by the Federal Subsistence Board, the taking of fish and wildlife on public lands for subsistence uses is restricted to Alaska residents of rural areas or rural communities. Non-rural residents are not provided a preference for the taking of fish and wildlife on public lands. In Southeast Alaska, Juneau and Ketchikan have been determined to be non-rural by the Federal Subsistence Board.

In 1988, a detailed subsistence resource and use inventory of the Tongass National Forest was started as part of the Tongass Land Management Plan (TLMP) Revision. The Tongass Resource Use Cooperative Study (TRUCS) of 1988 was conducted by the University of Alaska's Institute of Social and Economic Research in conjunction with the U.S. Forest Service, and the Division of Subsistence of the Alaska Department of Fish and Game (Kruse and Frazier 1988).

In the TRUCS, researchers went to over 30 communities in Southeast Alaska and conducted interviews with randomly selected households about their 1987 subsistence uses. As part of the interview, household residents were also asked to draw special maps of the areas used for hunting and fishing. As stated by Kruse and Frazier in the TRUCS (1988) it should be noted that all figures used in reporting subsistence are based on a sample of households. Therefore, it is entirely possible that actual amounts harvested were either higher or lower than reported by sample households. A detailed description of the survey is found in the Tongass Resource Use Cooperative Survey

Technical Report Number One from the Institute of Social and Economic Research, University of Alaska.

Goldschmidt and Haas (1946) identified the land-use patterns associated with Native communities that existed in the mid-twentieth century in Southeast Alaska (map of these areas is displayed in the Cultural Resources section). Comparing these maps with information from the 1987 TRUCS maps and ADF&G Subsistence Division maps, it appears that hunting and fishing use by Natives in Southeast Alaska is still tied to some extent to historic traditions of who may hunt and fish on which lands. Despite the introduction of technological innovations (such as large, modern boats) that would allow residents of Native communities to range much greater distances than in earlier periods, their use appears to be concentrated in locations generally conforming to traditional clan land ownership boundaries. The distribution of harvest locations for non-Native communities, on the other hand, is often apt to range over greater areas.

Subsistence is a complex issue covering many aspects of lifestyles which are embodied in the people who reside in Alaska. In striving to be sensitive to the subsistence needs of the users of the North Revilla Project Area, the Forest Service used data collected in the Tongass Resource Use Cooperative Survey (Kruse and Frazier 1988) and ADF&G deer harvest survey statistics to identify communities that use the Project Area; and met with Saxman community representatives to identify important subsistence use areas within the Project Area.

Affected Areas

Based on identified use of the Project Area, the following communities were selected to be analyzed: Metlakatla, Meyers Chuck, Saxman, Wrangell, Thorne Bay, and Ketchikan. Of these communities, all are designated rural except Ketchikan.

Metlakatla

Metlakatla is 41 nautical miles south of the North Revilla Project Area and on the west side of Annette Island. The 1990 census reported there were 1,407 people living in the community, of which 1,175 or 84 percent were Native. This community was established in 1887 when a band of Tsimshian Natives migrated from northern British Columbia. In 1891 Congress designated Annette Island an Indian reservation, the first in Alaska. The community did not participate in the Alaska Native Claims Settlement Act of 1971 (ANCSA) and does not have a village corporation. Their economy is based on sawmill operations of the Louisiana Pacific Annette Hemlock Mill, Annette Island Packing Company (a community owned cannery), Tamgas Creek Hatchery, and Metlakatla Indian Community Services.

Metlakatla subsistence use is over 71 pounds of edible harvest consumed per person per year. This supplements their relative low income and traditional cultural life styles. In the Project Area, Metlakatlans fish for salmon and hunt for deer.

Meyers Chuck

Meyers Chuck is a small fishing village with a seasonal population of 30 to 40 people located about 10 miles from the Project Area along the Clarence Strait on the northwest tip of Cleveland Peninsula. A natural, well protected harbor, Meyers Chuck has been a shelter for passing fishing boats caught in the stormy waters of Clarence Strait. Beginning in the late 1800's, the community grew after a cannery was established in Union Bay in 1916. Fishing is still the basic source of income, although

declining salmon populations have caused some residents to seek work in Ketchikan or on Prince of Wales Island. A community sponsored fish hatchery was constructed in 1977 with the hope of improving local fish supplies.

Meyers Chuck residents depend on subsistence activities to supplement the relatively low cash economy. Fish, berries, deer, and other local protein sources are an important element of the local economy. Subsistence use of salmon and deer within the Project Area has been reported by residents of Meyers Chuck. Over 414 pounds of edible harvest are consumed per person per year.

Saxman

Saxman was settled in 1894 by Tlingit Natives from Cape Fox and Tongass islands. The town was named after a Presbyterian teacher named Samuel Saxman, who along with a Native village elder, were lost at sea looking for a new school site. When established, a few Tlingits from the old village of Kahshakes joined the growing community. Under ANCSA, the Cape Fox Corporation was formed and is the economic base for Saxman. Cape Fox Corporation is counted among one of the major employers in the Ketchikan area, including the Westmark Cape Fox Lodge, Cape Fox Tours, and as owner of 23,000 acres forested land.

Today, about 266 villagers consume about 89 pounds of food a year from subsistence activities. In the Project Area, residents of Saxman travel 30 miles to fish for salmon, hunt for deer and bear, and trap for marten, crabs and shrimp.

Wrangell

Wrangell, located in the east-central portion of Southeast Alaska, is on the northern tip of Wrangell Island, about 7 miles from the mouth of the Stikine River and approximately 50 air miles from the Project Area. The 1990 population is reported as 2,479. Wrangell began as an important Tlingit site primarily because of its proximity to the Stikine River. Starting in 1811, the flags of three nations—England, Russia, and the United States—have flown over this community, with Russian and English interests centered on fur trading. When the United States purchased Alaska in 1867, a military post was established. Prospecting for gold along the Stikine River and later in the Cassiar District of northern British Columbia dwindled by 1916 and the economy changed to fishing, crab and shrimp trapping. Today, timber, fishing, and fish processing dominate Wrangell's economy. The largest single employer is Wrangell Forest Products, the largest operating sawmill in Alaska. More than 100 residents fish commercially. It is the major source of income for 50 percent of those residents. Tourism is a growing economic influence in the Wrangell area.

Wrangell subsistence use is approximately 164 pounds consumed per person every year. In the Project Area their reported use is for deer, salmon, crabs, shrimp, and halibut.

Thorne Bay

Thorne Bay is one of the youngest cities in Alaska. As the center of logging activity for the Ketchikan Pulp Company, the community quickly grew from a logging camp in 1962 to an incorporated city in August 1982. Thorne Bay may be reached by the Alaska Marine Highway, by road from other Prince of Wales communities, or by float plane. Thorne Bay is a full service community of fewer than 500 residents, with schools, medical and government facilities.

Currently, the economy of Thorne Bay is based on logging, commercial fishing, and charter boat operations. Fishing activities center around Thorne River, which has large runs of salmon and trout. Crabbing, clamming and shrimping are popular activities in the waters adjacent to the community.

Thorne Bay residents use the Project Area for deer hunting, but the use is light. About 187 pounds of subsistence food is consumed per person each year.

Ketchikan

Ketchikan is located in southern Southeast Alaska, on the southwest side of Revilla Island on Tongass Narrows opposite Gravina Island. Ketchikan is approximately 30 air/water miles from the Project Area.

The Ketchikan area was a summer fishing camp for the Tlingit Indians. Development began with a saltery at the mouth of Ketchikan Creek. Ketchikan was a boom town in the late 1800's. Since the early 1900's, timber products have been an important economic factor in Ketchikan. Because of its location as a transportation center, fishing center, and focus for the region's timber industry, Ketchikan grew rapidly in the 1950's. In 1954, a world scale pulp mill was built in Ward Cove, with a computer aided, laser scanning sawmill added to the site in 1989. Besides the pulp and saw mills, Ketchikan has over a dozen large and small fish processing establishments. While mining does occur within the area, it is not currently of any major economic significance.

Ketchikan's 1990 borough population was reported as 13,828. Ketchikan was not included in the TRUCS study, since it is defined as non-rural. Consequently, subsistence harvest information for this community is not available except for fish and game harvest information provided by ADF&G.

Other Communities and Camps

In addition to communities already discussed, the following are other communities that use the Project Area for subsistence gathering purposes: Loring, Margaret Bay Camp, and Neets Bay Hatchery Camp. Subsistence use by these communities is expected to have minimal impact on the area. Occasional hunts by the members of communities Tenakee Springs and Hydaburg have been attributed to the area.

Table 3-119 presents information taken from the 1988 TRUCS report detailing the importance of subsistence use for individual communities using the Project Area. Total harvest figures include additional food items, plants, and berries.

Table 3-119
Per Capita Subsistence Harvest for Rural Communities Which Use the Project Area for Subsistence Gathering Activities.

Community	Total Harvest Lbs.	Deer Harvest Lbs.	Other Mammal Lbs.	Salmon Harvest Lbs.	Other Fish Lbs.	Shellfish Harvest Lbs.	Birds/ Eggs Lbs.	Misc. Plants Lbs.
Metlakatla	71	11	1	20	18	15	2	4
Meyers Chuck	414	22	37	105	176	52	14	8
Saxman	89	17	7	33	19	9	1	3
Thorne Bay	189	37	6	48	74	19	2	3
Wrangell	164	20	24	30	43	41	2	4

SOURCE: ADF&G Community Profile Database Catalogue, Vol 1, 1991

Affected Resources

The Project Area supports a wide variety of resources that contribute to the maintenance of the subsistence lifestyle. Identified activities include harvest of fish, waterfowl, bear, deer, furbearers, clams, crabs, and shrimp; and the gathering of berries and seaweed. In addition, many residents use trees for firewood, lumber, and spruce roots and cedar bark for cultural expression. Of these resources fish, deer, black bear, furbearers, and waterfowl may be affected by the North Revilla Project and are analyzed in the following discussion.

Fish

Salmon and trout are the principal subsistence fish resources in the affected area. Pacific salmon are harvested in both fresh and salt water in a variety of ways throughout the year in the Project Area. The Sockeye and Chinook salmon are the most heavily used subsistence species because of their high quality flesh and ease of harvest at traditional sites. Traditional harvest sites for salmon within the Project Area include sockeye at Neets Creek and pinks at Traitors Creek.

Table 3-120 lists the stream, number of subsistence permits issued, and the number of fish taken by species for subsistence purposes. Neets and Traitors Creeks are shown as the principal salmon subsistence streams.

Table 3-120
Salmon Personal Use Permits and Harvest 1989-91.

Location	Permits Issued	Salmon Taken Chinook	Sockeye	Pinks	Chums
1985					
Traitors Creek	1	0	0	50	0
1990					
Neets Creek	3	0	12	0	0

SOURCE: ADF&G Commercial and Subsistence harvest data

Wildlife

For record-keeping purposes, the ADF&G has broken the Game Management Units (GMU's) into smaller areas called minor harvest areas. Minor harvest units are approximately comparable to Wildlife Analysis Areas (WAA). WAA's and their corresponding Value Comparison Unit (VCU's) within the North Revilla Project Area are found in Table 3-121.

Table 3-121
VCU's Within Minor Harvest Areas

WAA	VCU's
509	740
510	732, 733, 734, 735, 736, 737, 738, 739

SOURCE: Matson, 1993

Only about 10 percent of WAA 509 is within the North Revilla Project Area. WAA 509 includes the Naha watershed, a LUD II Eligible Wild and Scenic River area outside of the North Revilla Project Area boundary.

Deer

Harvest of deer on the Project Area is from rural users and non-rural users. Communities whose residents have hunted deer in WAA 510 since 1984 include: Ketchikan, Neets Bay and Margarita (Margaret) Bay logging camps, Loring, Juneau, Saxman, and Thorne Bay. Subsistence users came from: Metlakatla, Meyers Chuck, Saxman, Thorne Bay, Wrangell, Hydaburg, and Tenakee Springs. (Resource Harvest Map, 1990, ADF&G). Access is limited to boat or float plane.

Hunting effort in WAA 510 increased in 1989 due to the resumption of logging operations in the area. Most of the additional harvest was by Margarita (Margaret)

Bay logging camp residents. Harvest may increase as more logging, road building, and other development occur in the North Revilla Project Area.

The general hunting season is August through late December. Harvest is concentrated during two time periods: the first few weeks of the season in August, and later in November when the rut occurs. Most of the deer harvest in the Project Area occurs on shorelines or timber harvest access roads.

Locations where communities harvested deer within the North Revilla Project Area during 1987 to 1991 period are below in Table 3-122.

Table 3-122

VCU's within the Project Area Where Communities Harvested Deer during 1987-91

VCU	Metlakatla	Meyers Chuck	Saxman	Wrangell	Thorne Bay
732					
733	X	X	X		
734					
735	X		X		
736			X	X	
737			X	X	X
738			X	X	
739			X	X	
740			X		

Source: Zellmer, 1992. ADF&G Deer Harvest Data Base

The average number of deer harvested from 1987 through 1991 by each community for WAA's 509 and 510 is shown in Table 3-123. Ketchikan was included to illustrate the relative impact this community has on the area. An average of 20 deer per year in WAA 510 were taken by hunters from rural communities.

Subsistence hearings held in Ketchikan and Saxman revealed that some Saxman residents do not report their deer harvest to ADF&G, so the ADF&G harvest data is underreporting the importance of this area to residents of Saxman. Another problem with the ADF&G harvest data is that some Saxman residents have a Ketchikan mailing address, so some Saxman resident deer harvest is being reported as Ketchikan resident harvest. To help alleviate this problem, the IDT met with representatives from the community of Saxman, and important subsistence deer hunting areas for Saxman residents were mapped.

Table 3-123
Average Deer harvest by Community, by WAA for the Years 1987-91

Community	WAA 510	WAA 509
Ketchikan	32	45
Loring	0	0
Margarita Bay Logging Camp	11	0
Metlakatla	0	0
Meyers Chuck	0	0
Neets Bay	2	0
Saxman	0	0
Thorne Bay	7	0
Wrangell	0	0
Outside Alaska	0	0
Total Deer Harvest	52	45
Total Non-rural Harvest	32	45
Total Rural Harvest	20	0

SOURCE: ADF&G Deer Harvest Data For Southeast Alaska 1987-91.

The percentage of a communities deer harvest occurring within WAA's 509 and 510 is illustrated in Table 3-124.

Table 3-124
Average Deer Harvest by Community 1987-1991, and Percent of Total Harvest that Occurred within WAA's 509 and 510

Community	Ave. Deer Harvest Within Project WAA's	Ave. Deer Harvest All Areas	Percent of Harvest Within Project WAA's
Ketchikan	77	1,601	5
Loring	0	0	0
Margarita Bay Camp	11	11	100
Metlakatla	0	34	0
Meyers Chuck	0	20	0
Neets Bay	2	2	100
Saxman	0	8	0
Thorne Bay	7	352	2
Wrangell	0	331	0
Outside AK.	0	70	0

SOURCE: ADF&G Deer Harvest Data For Southeast Alaska 1987-91.

While Ketchikan accounted for the greatest number of deer harvested within the Project Area, it amounted to five percent of that community's total deer harvest. People living at the Neets Bay hatchery and Margarita (Margaret) Bay Logging Camp harvested all their deer from the Project Area WAA's. The Margarita (Margaret)

Bay Logging Camp is no longer in the Project Area; however, this level of harvest could be expected when another logging camp is moved in to harvest the proposed timber. The community of Thorne Bay's deer harvest showed up in the data only for the year of 1989. It is suspected that this harvest was by individuals who were staying at a logging camp in the Project Area. Since the deer harvest for the community of Thorne Bay occurred in the Project Area only one year out of four, it probably isn't a particularly important subsistence use area for the community of Thorne Bay.

TLMP Revision (1991a) produced a map that displayed areas ever-used for subsistence deer hunting by Southeast Alaska subsistence households; this map is incorporated by reference. This map shows that most of the Project Area has been used by only 1–10 subsistence households, with the exception of along the shoreline in Neets Bay and Traitors Cove.

Black Bear

Black bears occur throughout the Project Area and populations are currently stable.

The TRUCS effort indicated that some black bear harvest was associated with subsistence use, but that community use varies widely. Bear tagging information from ADF&G indicates hunters were usually from the Ketchikan area; only 2 bear out of 68 were harvested by residents of rural communities (Neets Bay and Petersburg).

Table 3-125 displays the black bear harvest by WAA by year. It appears that the recent harvest levels are being met by current habitat capability for the North Revilla Project Area.

Table 3-125
Black Bear Harvest from 1986 to 1991 and Population Needed to Support Harvest Compared to Current Habitat Capability.

WAA**	1986	1987	1988	1989	1990	1991	Average Harvest Per Year	Population to Support Harvest*	1993 Habitat Capability
509	1	0	1	2	2	2	1	10	117
510	11	8	17	6	6	12	10	100	252

SOURCE: Matson, 1993. Data derived from ADF&G harvest data
*Population needed to support harvest assumes a 10 percent harvest of the population (pers. comm. D. Larsen ADF&G Wildlife Biologist).
**Includes entire WAA, including portions outside the Project Area.

Table 3-126 displays the the black bear harvest in WAA's 509 and 510 broken down by harvest of individuals from rural and non-rural communities.

Table 3-126

Black Bear Harvest by Rural and Non-rural Communities during 1986-91

Year	WAA 509 Rural Harvest	WAA 509 Non-rural	WAA 510 Rural Harvest	WAA 510 Non-rural
1986	0	1	0	11
1987	0	0	1	7
1988	0	1	0	16
1989	0	2	1	6
1990	0	2	0	6
1991	0	2	0	12
Total	0	8	2	58

Source: Matson, 1993. ADF&G Black Bear Harvest Data Base

Furbearers

Furbearer harvest supplements the seasonal income of many area residents. Different levels of trapping intensity exist, from the occasional trapper who targets primarily marten and otter close to shore, to those individuals pursuing all furbearers both near to and far from the road system. Harvest effort usually is concentrated along the salt water-upland interface. Marten appear to be the most old-growth dependent of the furbearers, and are trapped intensively from shore and along the road system. All of the marten trapped in WAA 509 where trappped by residents of Ketchikan and Ward Cove. Residents of Bell Island, Neets Bay, and people staying at the Margarita Bay logging camp harvested 40 percent of the marten in WAA 510; the other 60 percent were harvested by residents of Ketchikan and Ward Cove (ADF&G Marten Harvest Database). It should be noted that there are wide yearly variations in harvest levels.

Table 3-127

WAA 509 Furbearer Harvest from 1986 to 1991

Animal	1986	1987	1988	1989	1990	1991	Total	Average Harvest Per Year	Population Needed to Support Harvest *	Habitat Capability 1993
Beaver	0	0	0	0	0	2	2	0	N/A	N/A
Marten	0	0	6	2	1	8	96	16	40	107
Otter	2	2	0	0	1	23	28	5	25	41
Wolf	3	0	2	1	1	1	8	1	N/A	N/A

SOURCE: ADF&G Data Base

* Population needed to support harvest assumes a 40 percent harvest of the marten population and a 20 percent harvest of the otter population.

Table 3-128
WAA 510 Furbearer Harvest from 1986 to 1991

Animal	1986	1987	1988	1989	1990	1991	Total	Average Harvest PerYear	Population Needed to Support Harvest *	Habitat Capability 1993
Beaver	0	2	3	2	0	0	7	1	N/A	N/A
Marten	17	23	100	99	91	116	446	74	185	198
Otter	8	9	3	22	5	0	47	7	35	86
Wolf	1	1	2	5	0	2	11	2	N/A	N/A

SOURCE: ADF&G Data Base
* Population needed to support harvest assumes a 40 percent harvest of the marten population and a 20 percent harvest of the otter population.

Table 3-129
Marten Harvest by Rural and Non-rural Communities during 1988-91.

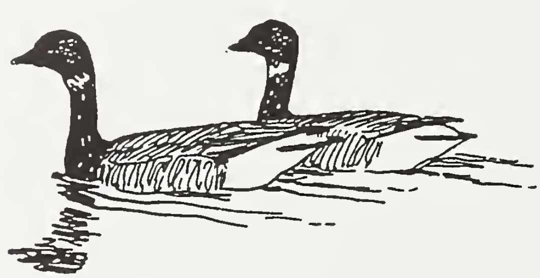
Year	AA 509 Rural Harvest	AA 509 Non-rural	WAA 510 Rural Harvest	WAA 510 Non-rural
1991	0	87	116	0
1990	0	1	43	48
1989	0	2	6	93
1988	0	6	0	100
Total	0	96	165.	241

Source: Matson, 1993. ADF&G Marten Harvest Data Base

Waterfowl

A variety of species of ducks, along with Canada geese, occur in the Project Area, primarily along bays and estuaries. Identified sites with a history of waterfowl use that are within the Project Area include:

Klu Bay
Neets Bay
Traitors Cove and the salt chuck.



810 Evaluation-Effects of the Alternatives

Introduction

Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) requires a Federal agency having jurisdiction over lands in Alaska to evaluate the potential effects of proposed land-use activities on subsistence uses and needs. Section 810 of ANILCA states:

> In determining whether to withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public lands under any provision of law authorizing such actions, the head of the agency having primary disposition over such lands or his designee shall evaluate the effects of such use, occupancy, or disposition on subsistence uses and needs, the availability of other lands for purposes sought to be achieved, and other alternatives which would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes. No such withdrawal, reservation, lease, permit, or other use, occupancy or disposition of such lands which would significantly restrict subsistence uses shall be effected until the head of such federal agency:

1. gives notice to the appropriate state agency and appropriate local committees and regional councils established pursuant to ANILCA Section 805;

2. gives notice of, and holds, a hearing in the vicinity of the area involved; and

3. determines that (A) such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the utilization of the public lands; (B) the proposed activity will involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition; and (C) reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such action.

This section evaluates how the proposed action alternatives could affect subsistence resources used by the rural communities found to use the Project Area, including: Metlakatla, Saxman, Thorne Bay, Meyers Chuck, Wrangell, and the non-rural community of Ketchikan. The subsistence resource categories evaluated are deer, furbearers, waterfowl, black bear, salmon, other finfish, shellfish, other food and cultural resources, and firewood.

Criteria used to evaluate the effects of the proposed alternatives are: (1) changes in abundance or distribution of subsistence resources; (2) changes in access to subsistence resources; and (3) changes in competition from non-rural users for those resources. The evaluation determines whether subsistence uses in the Project Area or portions of the Project Area may be significantly restricted by any of the proposed action alternatives.

The evaluation relies heavily upon the use of wildlife habitat capability models as well as upon ADF&G hunter survey data.

This subsistence evaluation considers whether or not there is a significant possibility of a significant restriction of subsistence use. The Alaska Land Use Council's definition of "significantly restrict subsistence use" is one guideline used in the findings. By this definition:

> A proposed action shall be considered to significantly restrict subsistence uses, if after any modification warranted by consideration of alternatives, conditions,

> or stipulations, it can be expected to result in a substantial reduction in the opportunity to continue subsistence uses of renewable resources. Reductions in the opportunity to continue subsistence uses generally are caused by: reductions in abundance of, or major redistribution of resources; substantial interference with access; or major increases in the use of those resources by non-rural residents. The responsible line officer must be sensitive to localized, individual restrictions created by any action and make his/her decision after a reasonable analysis of the information available.

The U.S. District Court Decision of Record in Kunaknana v. Watt provided additional definitions of "significant restriction of subsistence uses" and are also used as guidelines in the findings. The definitions from Kunaknana v. Watt include:

> Significant restrictions are differentiated from insignificant restrictions by a process assessing whether the action undertaken shall have no or slight effect as opposed to large or substantial effects. In further explanation the Director (BLM) states that no significant restriction results when there would be "no or slight" reduction in the abundance of harvestable resources and no occasional redistribution of these resources. There would be no effect (slight inconvenience) on the ability of harvesters to reach and use active subsistence harvesting site; and there would be no substantial increase in competition for harvestable resources (that is, no substantial increase in hunting by non-rural residents).

Conversely, restrictions for subsistence uses would be significant if there were large reductions in abundance or major redistribution of these resources, substantial interference with harvestable access to active subsistence use sites or major increases in non-rural resident hunting. In light of this definition, the finding of significant restriction must be made on a reasonable basis, since it must be decided in light of the total subsistence lands and resources that are available to individuals in surrounding areas living a subsistence lifestyle. This EIS evaluates the availability of subsistence resources in surrounding areas that could be accessed without undue risk or economic hardship to subsistence users.

Direct Effects

Tables 3-130 through 3-133 display habitat capabilities for Sitka black-tailed deer. Based on this analysis deer will be reduced the most in WAA 510, but adequate habitat would remain to support enough deer to meet current and projected demand.

Table 3-130
Habitat Capability Compared to Demand for Sitka Black-tailed Deer in 1997

WAA	Ave.* Harvest 1987-91	Pop. Needed to Support Harvest**	1993 Habitat Capability***	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
509	45	450	1,385	1,385	1,384	1,384	1,382	1,382	1,384
510	52	520	1,947	1,947	1,839	1,863	1,866	1,878	1,849

SOURCE: Matson, 1993
* Source: ADF&G Deer Harvest Data For Southeast Alaska 1987-91.
**Population needed to support harvest assumes a 10 percent harvest of the population as recommended by Flynn and Suring (1989).
***Habitat capability numbers do not incorporate patch-size effectiveness calculations.

A decrease in habitat capability varies from 8 percent for Alternative 2 in WAA 510 to 6 percent in Alternatives 3, 4 and 5 as illustrated by Table 3-1131

Table 3-131
Percent Decrease from 1993 Deer Habitat Capability by Alternative

WAA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
509	0%	<1%	<1%	<1%	<1%	<1%
510	0%	-6%	-4%	-4%	-4%	-5%

SOURCE: Matson, 1993

Based on the outputs of the Habitat Capability Models for deer, adequate habitat would be available to support current and projected harvest levels through 2040 (Figures 3-29 and 3-30) in both WAA's 509 and 510. Current demand is assumed to be the average deer harvest from 1987-91 for each of the Project Area WAA's. To determine future demand for deer, the current demand was increased by 1.8 percent per year though the year 2010, and 1.5 per year from 2010 to the year 2040.

The projected number of deer available for harvest in the year 2040 should be sufficient to meet the projected demand for both rural and non-rural hunters in WAA's 509 and 510.

Figure 3-29
Estimated Deer Availability and Demand in WAA 509

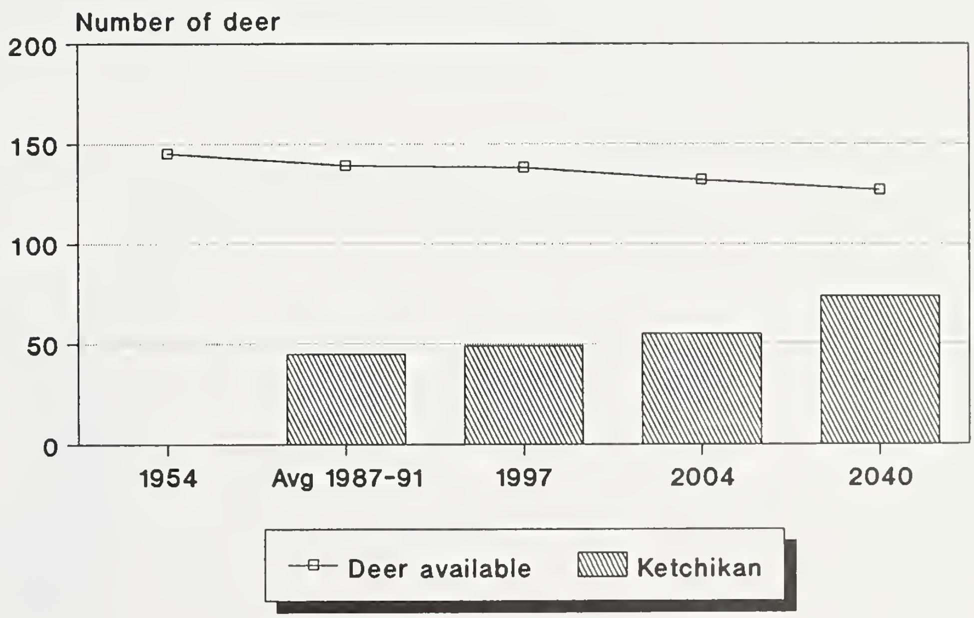
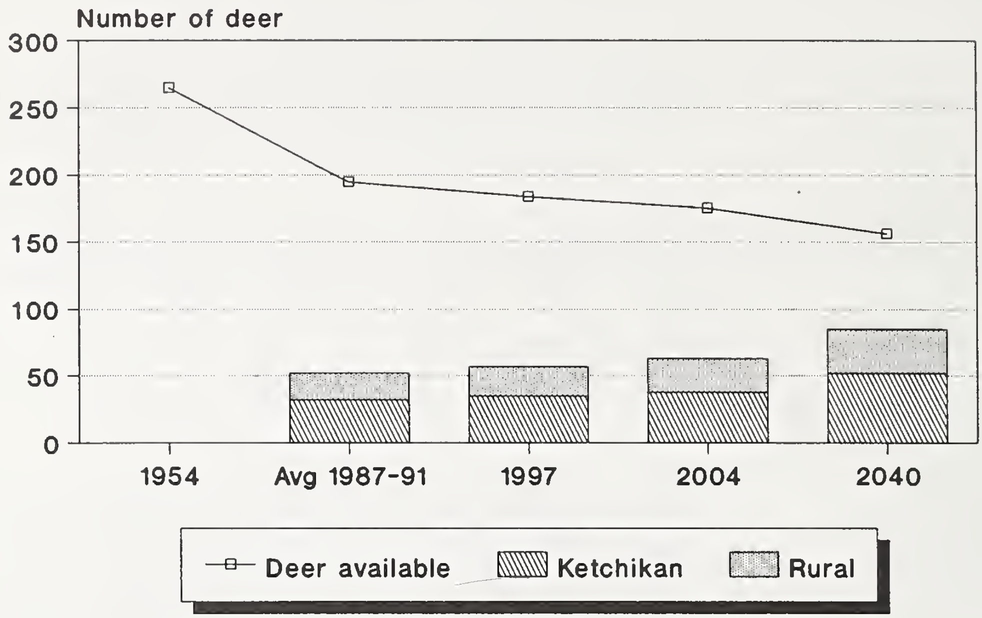


Figure 3-30
Estimated Deer Availability and Demand in WAA 510



NOTE: Rural harvest is 55 percent Margarita Bay Logging Camp, 35 percent Thorne Bay, and 10 percent Neets Bay Logging Camp

Deer: Reasonably Foreseeable Future Actions

Table 3-132 displays the effect of harvesting North Revilla and other planned harvest activities taking place on Revillagigedo Island between now and the year 2004 (end of the Long-Term Contract with KPC). Table 3-132 also compares the deer habitat capability in 2004 to the 1991-95 ADF&G Deer Population Objectives for all the WAA's on Revillagigedo Island. Habitat capability meets or exceeds ADF&G Deer Population Objectives in all WAA's except 407 and 510. All WAA's that are below the Population Objective still have a remaining habitat capability within 90 percent of the Objective.

ADF&G Deer Population Objectives for WAA's 407 and 510 have been set at the current habitat capability due to significant habitat reductions due to timber harvest or high hunting demand.

Table 3-132
Deer Habitat Capability Reductions on National Forest System Lands, by Project and WAA for Revillagigedo Island by 2004

	FS Lands		Habitat Capability Reduction, in Number of Deer					FS Lands	
WAA	Current Hab.Cap.	Shelter Cove	Revilla EIS Alt.6	Upper Carroll *	Three Creeks *	Sea Level EIS *	Total Reductions	Hab.Cap. 2004	ADF&G Pop.Obj.
404	3,063						0	3,063	3,063
405	2,103					- 87	87	2,016	1,651
406	2,659	-160		- 85			245	2,414	2,202
407	1,126	- 80			- 24		104	1,022	1,126**
408	478						0	478	478
509	1,385		- 1		- 40		41	1,344	1,090
510	1,947		- 98	- 85			183	1,764	1,947**
511	306							306	306
TOTAL	13,067	-240	- 99	-170	- 64	- 87	660	12,407	11,863

* Proposed EIS's that have not been analyzed yet, habitat capability reductions were estimated (using a 1.3 reduction in deer habitat capability for every MMBF.

** Projects in this WAA will reduce the habitat capability to less than the ADF&G Deer Population Objectives. SOURCE: Matson 1993.

Table 3-133 displays the reasonably foreseeable action occurring on Prince of Wales Island. This table is included because many Ketchikan and Saxman residents take the ferry to Hollis and utilize the road system on Prince of Wales Island for deer hunting. The community of Ketchikan harvests approximately 50 percent of their deer from Prince of Wales Island (ADF&G Deer Harvest Data).

Table 3-133
Deer Habitat Capability Reductions on National Forest System Lands, by Project and WAA for Prince of Wales Island by 2004

WAA	FS Lands Current Hab.Cap.	Habitat Capability Reduction, in Number of Deer Polk DEIS Alt. 3	Lab Bay Alt. B	CPOW Alt. F5	CPOW Nxt Entry	Salt Lake EA Alt.3	Control L. Estimate	FS Lands Hab.Cap. 2004	ADF&G Pop.Obj.
1107	6,915	- 1						6,914	5,275
1211	2,187							2,187	1,653
1212	1,362							1,362	1,024
1213	1,197	- 6						1,191	906
1214	1,749	- 18						1,731	1,450
1315	2,838			- 72	- 84			2,682	2,838**
1316	827							827	827
1317	1,093	- 27						1,066	1,093**
1318	1,796						- 33	1,763	1,796**
1319	2,857			- 35	- 31		-165	2,626	2,857**
1323	1,981					- 46	- 51	1,884	1,497
1332	2,805	- 11						2,764	2,292
1420	1,035			- 23	- 79			933	1,035**
1421	3,073			- 27	-170		- 41	2,876	3,073**
1422	4,412			-165	- 99			4,148	4,288**
1527	1,730		- 40	- 1	- 14			1,675	1,520
1528	378		- 11					367	378**
1529	2,501		- 63					2,438	2,501**
1530	1,861		- 41	- 4	- 50			1,766	1,861**
TOTAL	42,597	- 63	-155	-327	-527	- 46	-290	41,200	38,164

* Current habitat capability is assumed to be the same as that listed in TLMP Revision for 1990.
** Projects in this WAA will reduce the habitat capability to less than the ADF&G Population Objectives.
SOURCE: Matson 1993. Data derived from ADF&G Hunter Survey Summary Statistics 1987-1990.

Black Bear

The direct effects of the proposed action on black bear habitat capability is less than 1 percent. There is no indication from the models that black bear habitat capability will be significantly diminished due to the proposed action as illustrated by Table 3-134 and Table 3-135.

Table 3-134
Habitat Capability for Black Bear by Alternative for WAA's 509 and 510

WAA	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
509	117	117	117	117	117	117
510	252	250	251	251	250	250

SOURCE: Matson, 1993

Table 3-135
Percent Decrease from 1993 Black Bear Capability by Alternative

WAA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
509	0%	0%	0%	0%	0%	0%
510	0%	<1%	<1%	<1%	<1%	<1%

SOURCE: Matson, 1993

Indirect and Cumulative Effects

Indirect and cumulative effects on bear habitat capability are displayed in Table 3-136, which exhibits the overall effect of change to habitat capability in comparison to the population needed to support current harvest levels. Table 3-137 gives the percentages of these changes.

Table 3-136
Habitat Capability Indirect and Cumulative Effects for Black Bear

WAA	Population Needed to Support Harvest	Initial 1954 Habitat Capability	Current 1993 Habitat Capability	Indirect 2040 Habitat Capability	Cumulative 2140 Habitat Capability
509	10	118	117	117	91
510	100	271	252	234	175

SOURCE: Matson, 1993

Table 3-137
Percent Change from 1954 in Habitat Capability Effects for Black Bear.

WAA	Current 1993 Change	Indirect 2040 Change	Cumulative 2140 Change
509	-1%	-1%	-23%
510	-7%	-14%	-35%

SOURCE: Matson, 1993

Based on the outputs of the habitat capability models for black bear, there should be adequate habitat available to support the current level of harvest through the year 2140.

Direct Effects

Furbearers

The direct effects of the proposed action are shown in Table 3-138, Furbearer Habitat Capability by alternative. Habitat capability estimates were derived from computerized models of management indicator species (MIS) for marten and otter. Wolf and beaver are not MIS for this EIS.

Table 3-138
Furbearer Habitat Capability by Alternative

WAA	Population Needed to Support Ave. 1986-91 Harvest	1993 Habitat Capability	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
509								
Marten	40	107	107	107	107	107	107	107
Otter	25	41	41	41	41	41	41	41
510								
Marten	185	198	198	181	185	187	186	184
Otter	35	86	86	85	85	85	85	85

SOURCE: Matson, 1993

Table 3-139
Percent Change from 1993 Furbearer Habitat Capability by Alternative

WAA	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6
509						
Marten	0%	0%	0%	0%	0%	0%
Otter	0%	0%	0%	0%	0%	0%
510						
Marten	0%	-9%	-7%	-6%	-6%	-7%
Otter	0%	-1%	-1%	-1%	-1%	-1%

SOURCE: Matson, 1993

The habitat capability of the Project Area will remain essentially the same for river otter and for marten will decrease 9 percent for Alternative 2, 6 percent for Alternatives 4 and 5, and 7 percent for Alternatives 3 and 6.

Indirect and cumulative effects for WAA 509 were found to be negligible. However, the indirect effects on marten in WAA 510 are estimated to be a 23 percent reduction in habitat capability. All action alternatives will reduce the current marten habitat capability to the amount needed to support the 1986-91 harvest level. The long-term cumulative effects by 2140 are estimated to be a 26 percent reduction in marten since 1954.

Table 3-140

Habitat Capability Indirect and Cumulative Effects of Furbearers

WAA	Population Needed to Support Ave.1986-91 Harvest	Initial 1954 Habitat Capability	Current 1993 Habitat Capability	Indirect 2040 Habitat Capability	Cumulative 2140 Habitat Capability
509					
Marten	40	110	107	107	107
Otter	25	42	41	41	41
510					
Marten	185	239	198	178	120
Otter	35	108	86	85	85

SOURCE: Matson, 1993

Table 3-141

Percent Change from 1954 in Habitat Capability Effects on Furbearers

WAA	Current 1993 Change	Indirect 2040 Change	Cumulative 2140 Change
509			
Marten	-3%	0%	0%
Otter	-2%	0%	0%
510			
Marten	-17%	-26%	-50%
Otter	-20%	-21%	-21%

SOURCE: Matson, 1993

Waterfowl

Effects of the proposed action on waterfowl are expected to be minimal because no timber harvest will be permitted within 1,000 feet of estuaries, or within 500 feet of shorelines. Timber harvest unit locations generally avoid important waterfowl areas, including: estuary grass flats, beach fringe and borders of inland lakes and streams.

Firewood and Lumber

Current use of both live and dead timber for subsistence is very low throughout the Project Area. Except for firewood use by the Forest Service camp at Margaret Bay, no additional need for wood in the North Revilla Project Area has been expressed. In terms of effects, there may be a immediate localized temporary use by logging camps, but indirect and cumulative demand is expected to return to current use rates.

Other Resources

Other subsistence uses of the natural resources occur. Some examples are cedar bark gathering, berry picking, mushroom gathering, use of native plants for arts and crafts, use of bays and estuaries, collecting of other edible plants and animals. Most of these activities are associated with a particular traditional site.

ANILCA 810 Findings for Subsistence Use of the Project Area

Abundance and Distribution of Subsistence Resources

The harvest of old-growth habitat may reduce the abundance of deer, black bear, and marten, based on the Habitat Capability models for these species. Timber harvest proposed by the action alternatives will reduce the deer habitat capability in WAA 510 between 6 and 8 percent (Table 3-132). Black bear habitat capability will be reduced by less than 1 percent for all action alternatives (Table 3-135). Marten habitat capability in WAA 510 will be reduced by 6 to 9 percent (Table 3-141), which is right at the amount required to meet current demand. The most significant decrease in deer and marten habitat capability for WAA 510 is in 2140, 62 percent for deer (Table 3-132), and 50 percent for marten (Table 3-141) as a result of additional timber harvest in the future. Other subsistence resources such as salmon, waterfowl, berries, edible plants, and cedar bark are not anticipated to be reduced in abundance. Distribution of the subsistence resources is not expected to change.

Access

Access to traditional subsistence-use areas will not be restricted by the proposed project. Traditional subsistence access is by boat to the beaches of the Project Area. The effect on access would probably be minor under all alternatives because no beach fringe will be harvested in the Project Area and less than one percent of the marine and estuarine habitat will be affected by logging activities.

New and rebuilt roads will provide access to areas that were not previously used for subsistence harvesting resources. (See Alternative maps, separate map packet, for details.) Miles of road proposed for construction are can be found in the Roads and Facilities section. Mechanized use of the road system will be limited due to ability to access the Project Area, which is by boat.

Road management prescriptions developed for Project Area roads will take subsistence user into consideration.

Competition

Competition for subsistence resources in the Project Area is a scoping issue. Subsistence users are concerned with competition from residents of Ketchikan. Since Ketchikan residents are considered non-rural, this competition can be regulated if it starts to restrict non-rural residents' ability to obtain subsistence resources. Deer habitat capability in WAA's 509 and 510 is presently adequate to sustain all current and projected harvest now and through the year 2040. In the Wildlife Section, the cumulative analysis discussed a potential road connection between the Project Area and the Ketchikan road system. If such a connection is made, it would significantly increase the amount of rural and non-rural use of the area and could increase the amount of competition to the point that there would be a significant restriction in subsistence use of deer and marten in the Project Area.

The Federal Subsistence Board may use its authority to regulate non-rural harvest of deer and has authority to prioritize the harvest of deer among rural residents when necessary to protect the resource. The current deer population level does not require restrictions on non-rural users.

There is no evidence to indicate that availability of salmon, finfish, shellfish or other food resources to subsistence users would be affected by sport or non-rural harvest. Any increase in competition from non-rural Alaskan residents and nonresidents would not be substantial because of the availability of resources in the immediate vicinity and in the surrounding areas.

The above analysis indicates that the actions proposed in Alternatives 2 through 6 will not represent a significant possibility of a significant restriction on subsistence use of deer, black bear, or otter in the Project Area. Marten harvest in WAA 510 is at the peak of the level that can be sustained. With future reductions of habitat capability for deer and marten, and in light of the fact that Saxman residents' use of the area is underreported for the Project Area, there may be a significant possibility of a significant restriction of subsistence use of marten and deer at some point in the future.

EIS Conclusions

Section 810 (a) (3) of ANILCA requires that when a significant restriction may occur, determinations must be made with regard to whether:

- Such a significant restriction of subsistence uses is necessary and consistent with sound management principles for the utilization of public lands;
- The proposed activity will involve the minimum amount of public lands necessary to accomplish the purposes of such use and occupancy, or other disposition;
- Reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions.

Necessary and Consistent with Sound Management of Public Lands

The alternatives proposed in the North Revilla EIS have been examined to determine whether they are necessary and consistent with sound management of public lands. In this regard the National Forest Management Act of 1976, the ANILCA, the Alaska Regional Guide, the TLMP, the TLMP 1985-86 Amendment, 1992 TLMP Revision Draft EIS, the Alaska State Forest Practices Act, and the Alaska Coastal Zone Management Program have been considered.

The ANILCA placed an emphasis on the maintenance of subsistence resources and lifestyles. The TTRA removed the 4.5 MMBF requirement from ANILCA but directed the Forest Service "to the extent consistent with providing for the multiple use and sustained yield of all renewable forest resources, [to] seek to provide a supply of timber from the Tongass National Forest which (1) meets the annual market demand for timber from such forest and (2) meets the market demand from such forest for each forest for each planning cycle", and left the volume requirements and contract area of the KPC contract in place.

The alternatives presented here encompass five different approaches that would produce the resources that would best meet the purpose and need of this EIS. All of the alternatives involve some potential to affect subsistence uses. There is no alternative that will avoid a significant possibility of subsistence restrictions somewhere in the Forest. Therefore, based on the analysis of the information presented in this document on the proposed alternatives, these actions are necessary and consistent with the sound management of public lands.

Amount of Public Land Necessary to Accomplish the Purpose of the Proposed Action

Appendix A addresses the availability of other lands within the KPC contract area suitable for the timber harvest. Much of the Tongass National Forest is used by one or more rural communities for subsistence purposes for deer hunting. The areas of most subsistence use are the areas adjacent to existing road systems, the beaches, and the areas in close proximity to communities. Within the Project Area, the extent and location of the subsistence use area precludes complete avoidance. Areas other than subsistence use areas that could be harvested may be limited by other resource concerns such as: soil and water protection; high value wildlife habitat; economics; visuals; or unit and road design. Effort was taken to protect the highest value subsistence areas. For example, beach fringe is one of the highest use subsistence areas and none will be harvested under any of the proposed alternatives.

The impact of viable timber harvest projects always includes alteration of old-growth habitat, which in turn always reduces projected habitat capability for old-growth-dependent species. It is not possible to lessen harvest in one area and concentrate it in another without affecting one or more rural communities' important subsistence use areas. In addition, harvestable populations of game species could not be maintained in a natural distribution across the Forest if harvest were concentrated in specific areas. A well distributed population of species is also required by the Forest Service regulations implementing the National Forest Management Act (NFMA).

Reasonable Steps to Minimize Adverse Impacts Upon Subsistence Uses and Resources

Reasonable steps to minimize impacts on subsistence have been incorporated in development of the alternatives and project design criteria. Project design criteria called for locating roads and units outside of important subsistence use areas such as the beach fringe, estuary fringe, and riparian areas adjacent to salmon streams. During development of alternatives, an effort was made to minimize activities that could adversely affect important subsistence use areas.

EIS Conclusions

The Record of Decision (ROD) for the Final EIS for the North Revilla Project will include a final Finding about the significant restriction on subsistence uses that may result from implementation of the selected alternative. Below is a summary of the EIS evaluation and findings.

1. The potential foreseeable and cumulative effects from the action alternatives in the North Revilla project may represent a significant possibility of a significant restriction of subsistence uses of deer and marten.

2. The potential foreseeable effects from the action alternatives in the North Revilla Project do not present a significant possibility of a significant restriction of subsistence uses of deer, black bear, otter, marten, marine mammals, waterfowl, salmon, other finfish, shellfish and other foods.

3. Due to the fact that Saxman residents' use of the Project Area is underreported in the data, there is a possibility that at some point in the future it may be necessary to restrict the non-rural harvest of deer and marten and give rural residents priority.

Hearings

On the basis of findings of this analysis and under the provisions of the Alaska National Interest Lands Conservation Act, subsistence hearings were held on the dates, times, and at the places announced in the letter accompanying the Draft EIS. These included: January 25, 1993 at Ketchikan and January 27, 1993 at Saxman. Letters were sent to the Federal Subsistence Board, Alaska Department of Fish and Game, Regional Fish and Game Advisory Councils, Local Fish and Game Advisory Committees, and to the Post Offices in Metlakatla, Meyers Chuck, Ketchikan, Saxman, and Thorne Bay to inform people of where hearings will be held. Announcements were also made in the *Ketchikan Daily News*, Jan. 25 and 26, 1993; and an article in the paper December 28, 1992 also announced the dates of the Subsistence Hearings.

Testimony at the hearings was both verbal and written; verbal comments were recorded and transcribed by an official court reporter. Testimony received, both verbal and written, was analyzed and incorporated into the Final EIS, as determined to be necessary by the Forest Service. For further details on responses to the comments received during subsistence hearings, see Appendix L.

CULTURAL RESOURCES

Key Terms

Cultural Resources - all evidence of past human-related activity, dating from the earliest beginnings to the fairly recent past
Sensitivity Zone - defined as "high," or "low," based on the probability that they might contain cultural resources
SHPO - State Historic Preservation Officer

Affected Environment

Introduction

Cultural resources include all evidence of past human-related activity, dating from the earliest beginnings to the fairly recent past.

The North Revilla Project Area has a unique cultural history, which includes the potential for occupation dating from the Paleomarine-Early Prehistoric Maritime period (10,000 B.C. - 4500 B.C.) through the Northwest Coast Developmental Phase-Late Prehistoric Maritime (4500 B.C. - A.D. 1700) to the protohistoric-historic Tlingit. Prehistoric remains include campsites, village sites, graves, resource areas, rock art, portages, and rock shelters. Historically, the various traders, miners, fishermen, loggers, subsistence users, and the USDA Forest Service (from 1907 to the present) have had an effect on the area. Historic sites include culturally modified trees, houses, cabins, mines, quarries, trails, portages, tramways, salteries, canneries, boatworks, boats, and shipwrecks.

The oldest sites located in Southeast Alaska to date are approximately 10,000 years old and are characterized by microblades (small stone blades with sharp cutting edges) and microblade cores (the prepared stone from which blades are removed) (Ackerman 1985; Davis, 1989, 1990). These types of tools are thought to be associated with cultures which adapted to a marine resource economy, and which were present approximately 10,000 to 5,000 years ago. This technology seems to have been replaced by a ground and polished slate tool industry (Davis et al. 1989, Davis 1990). More recent sites include mine, cannery, saltery, and historic cabin sites.

Many of these cultural remains provide the only record of former human occupation, work areas, and lifestyles. Some of these sites may represent cultural traditions associated with early human migration into Alaska, and others may be significant for European exploration and historic economic development. Additionally, some areas may have traditional or spiritual significance for contemporary Native Alaskans. The recovery of information from these sites and objects is important in reconstructing previous human behavior and adaptation in response to environmental or social

change and, represent an important part of our local, regional, and national cultural heritage.

Ethnohistory

The North Revilla Project Area is included in the traditional homeland of the Tlingit. Immediately prior to the time of European settlement, the Project Area was occupied by two Southern Tlingit groups, the Sanyakwan (also referred to as Saxman or Cape Fox Tribe) and Tantakwan (also referred to as Tongass or Ketchikan Tribe). The northern half of Revillagigedo (Revilla) Island was also apparently occupied at one time by the Xetlkwan (Foam House People or the Stikine Tribe) who more recently reside in the Wrangell area.

The Stikine are said to have originally settled at the mouth of the Chickamin River. Both the Cape Fox and Tongass tribes have origin stories which suggest population movement from the mainland through the mouth of the Unuk River (on the mainland northeast of Revilla Island), but have had separate histories since that time. The original territory of the Cape Fox Tribe (from north to south) included the southwest portion of the Cleveland Peninsula, the southern half of Revilla Island, and the west coast of the mainland south to the Portland Canal area (Goldschmidt and Haas 1946: 134).

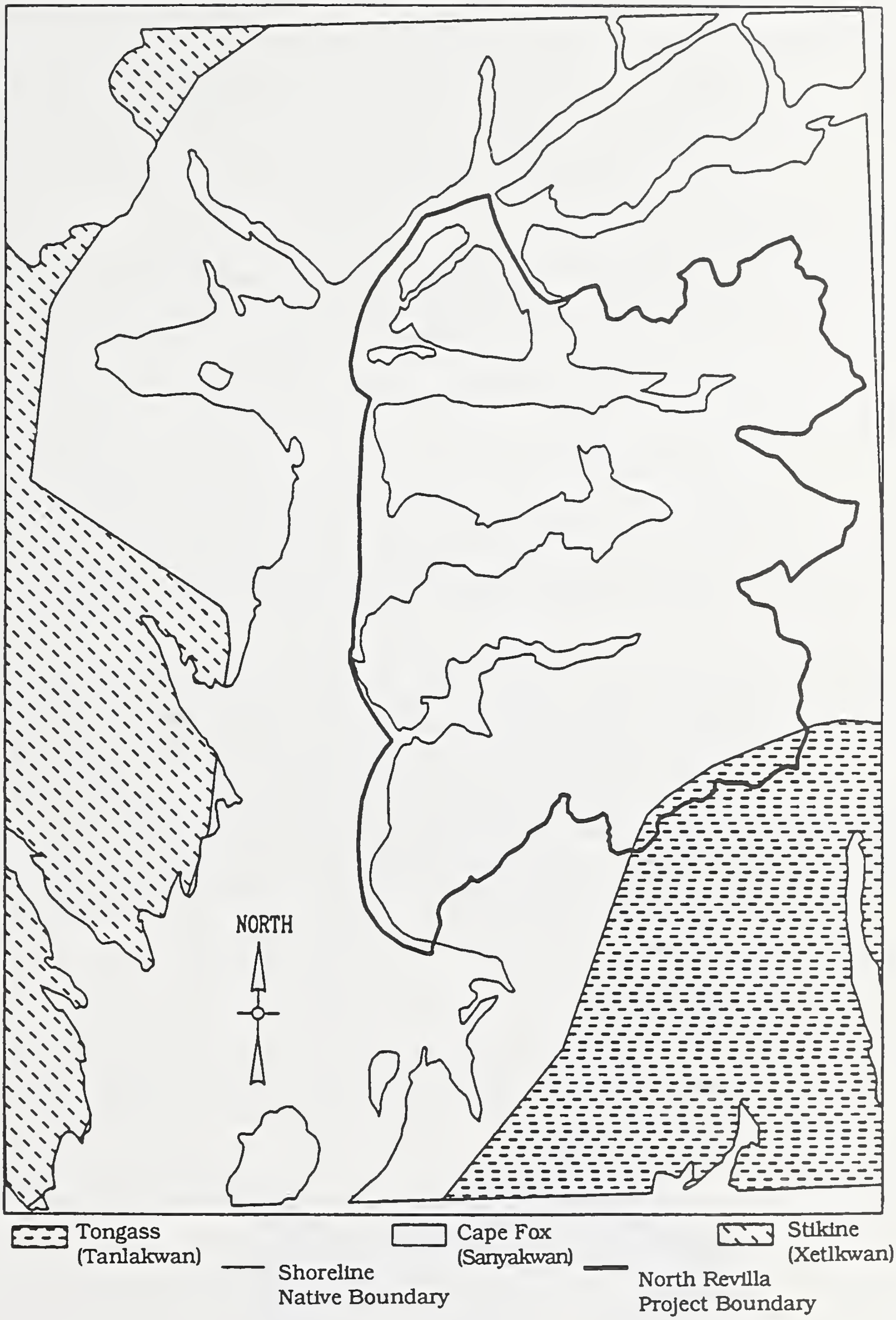
Although the Cape Fox Tribe remained in place on Revilla Island, the Tongass Tribe has a long history of migration. Originally centered on the southern one-third of Prince of Wales Island, the Tongass Tribe, as a result of Kaigani Haida encroachment which began around 1720, migrated east. The resulting displacement and competition for resources eventually led to major conflicts between the Tongass and both the Cape Fox and Stikine Tribes in the early part of the nineteenth century. As a result, the Stikine abandoned the area and moved to Wrangell, their territory absorbed by the Cape Fox; the Tongass in the end effectively displaced the Cape Fox from their southern territory and the southwest coast of Revilla Island. By the end of the nineteenth century, however, due to increased Euro-American influence in the area, both groups consolidated and established separate settlements on the southwest coast of Revilla Island: the Tongass at the present day city of Ketchikan, the Cape Fox at Saxman (Arndt, Sackett and Ketz 1987: 85-162).

The historic period in Alaska began with the second Kamchatka Expedition of Vitus Bering in 1741 and developed through various stages of contact with European people and goods. Historic explorations in the Project Area occurred in 1792 with Jacinto Caamano expedition and in 1793 when George Vancouver's long boats explored Behm Canal from Port Protection where the British ships Discovery and Chatham were anchored (Mobley 1989; p9).

The remains of many of these sites, both historic and prehistoric, provide the only record of former human occupation, work areas, and lifestyles within the Project Area. There may also be sites within the Project Area which have religious or cultural significance for Native Alaskans that have not yet been identified.

Figure 3-31 displays the areas of the Tongass, Cape Fox, and Stikine tribes in and around the Project Area as depicted by G.T. Emmons in 1888.

Figure 3-31
North Revilla Project Area Primary Native Cultures



Cultural Resources Inventory

In accordance with the National Historic Preservation Act of 1966, as amended, the National Environmental Policy Act of 1969, and a series of implementing regulations and policy direction, the Ketchikan Administrative Area of the Tongass National Forest is undertaking a program to identify, evaluate, preserve, and protect cultural resources as a nonrenewable national heritage. An Inventory Plan/Research Design has been prepared by the Ketchikan Administrative Area archeologist which will provide a planned outline for conducting complete archaeological surveys in certain prescribed areas of the Project Area. The purpose of the cultural resource investigations is to identify any possible impacts that the proposed activities would have on recorded cultural resources in the area that may be eligible for inclusion in the National Register of Historic Places.

USDA Forest Service, Region 10 Cultural Resource Guidelines define high, medium and low "sensitivity zones," which are based on the probability that they might contain cultural resources. Refinement of this concept was initially proposed in the survey design for Kelp Bay (Davis et al. 1991). Additional modifications are detailed within the Draft Ketchikan Area Research Design. Through a review of existing data and analyses, areas of higher sensitivity for locating various historic or prehistoric site types are determined. All areas between zero and 100 feet above sea level, proximity to known site locations at any elevation, lakes and streams containing salmon species within 100 feet above sea level, passes and portages, known previous land use patterns, fossil beaches, and myth or legend sites are designated high sensitivity zones and require a search of existing data and field investigation. Low sensitivity zones include all other areas with slope angles greater than 30 percent, muskegs, and areas where, because of specific environmental conditions, the probability of the occurrence of cultural resources is so low it is essentially zero.

The analysis process for the cultural inventory began with an existing data search to identify any previous work and cultural sites located within the Project Area and/or near the proposed harvest units. A number of sources were consulted, including the Alaska Heritage Resources Survey (AHRS), the National Register of Historic Places (NRHP), the Forest Service site and survey files, and the Tongass National Forest Cultural Resources Overview (Arndt, Sackett and Ketz 1987). A literature overview that included ethnohistoric information pertinent to the Southeast Alaska Natives and other ethnic groups who have prehistoric and historic ties to the lands within the National Forest was supplemented by public comment and any additional reports submitted to the Forest Service that might pertain to the area presently under consideration.

Previous Work

Few systematic archaeological investigations have been conducted in the Project Area. The majority of the documentation are unpublished field notes on file. The following is a summary of those which have been performed in the immediate vicinity and the subsequent findings.

- 1975: a pedestrian reconnaissance at selected Native claim areas documents one recorded site, KET-053.

- 1977: a) an aerial reconnaissance (fly-over) augmented by pedestrian reconnaissance in selected areas in the vicinity of Traitors Cove revealed no cultural resources; b) an aerial reconnaissance in the vicinity of Naha Bay revealed no cultural resources; c) a pedestrian reconnaissance in the vicinity of Indian Point recorded several culturally modified trees (such as trees which have had

bark stripped from them, been utilized for their pitch content, or been used as a small animal trap); d) a pedestrian reconnaissance in the vicinity of Margaret Cove revealed several culturally modified trees; e) an aerial reconnaissance in the vicinity of Neets Bay revealed no cultural resources; f) an aerial reconnaissance augmented by pedestrian reconnaissance in selected areas in the vicinity of Klu Bay revealed no cultural resources; g) an aerial reconnaissance of Hassler Island revealed no cultural resources.

- 1978: an intensive pedestrian survey was conducted along the shores of Margaret Bay. No cultural resources were located.
- 1979: pedestrian reconnaissance of various locales along northern Revillagigedo (Revilla) Island located a fish weir complex, petroglyphs, KET-071, culturally modified trees, a possible village site, KET-061, and located the debris associated with recent logging activity at Klu Bay. No evidence of cultural resources were located in a cove on the eastern shore of Hassler Pass.
- 1982: a pedestrian reconnaissance at the head of Neets Bay located no cultural resources.
- 1985: a pedestrian reconnaissance located one site, (KET-100) in Traitors Cove.
- 1986: a pedestrian reconnaissance of Shrimp Bay recorded one site (KET-098).
- 1987: a pedestrian reconnaissance along Klu Creek and Klu Bay located no cultural resources.
- 1987: a pedestrian reconnaissance at Traitors Cove revealed no cultural resources.

Previous investigations account for approximately 800 acres within the Project Area.

Eight cultural resource sites are located in the Project Area, including a diverse range of prehistoric and historic sites and artifacts. Prehistoric remains include campsites, village sites, graves, resource areas, and rock art. Historic sites include culturally modified trees (CMT'S), cabins, and a gold mine prospect.

Table 3-142 displays known sites by VCU, Alaska Heritage Resource Survey (AHRS) Site Number, relative elevation above sea level, whether the site is historic or prehistoric, and relative location in regard to the coast.

Table 3-142
Known Sites and Mines within the Project Area

Site Type	AHRS	Elevation	Date	Dist. to Salt Water
VCU 733	KET-098	<100	Prehistoric	<100
	KET-062	<100	Historic	<100
VCU 738	KET-100	<100	Historic	<100
	KET-070	<100	Historic	<100
	KET-061	<100	Prehistoric	<100
VCU 740	KET-053	<100	PRE/HIS	<100
VCU 763	KET-099	<100	Prehistoric	<100
VCU 738	GOLD MN63	Unknown	Historic	Unknown

Total Number of Sites: 8

SOURCE: Reported ethnographic resource areas in the Project Area.

Areas indicated by Tlingit place names (Waterman 1922) along the Project Area's coastline to be traditional use areas have been identified. While place names do not always indicate the location of archaeological or historical resources (cultural resources), the place names suggest use and familiarity with geographic location and association with legends. All of these associations have varying degrees of potential for locating cultural resources. Tlingit place names in the Project Area as identified by Waterman are shown in Figure 3-32.

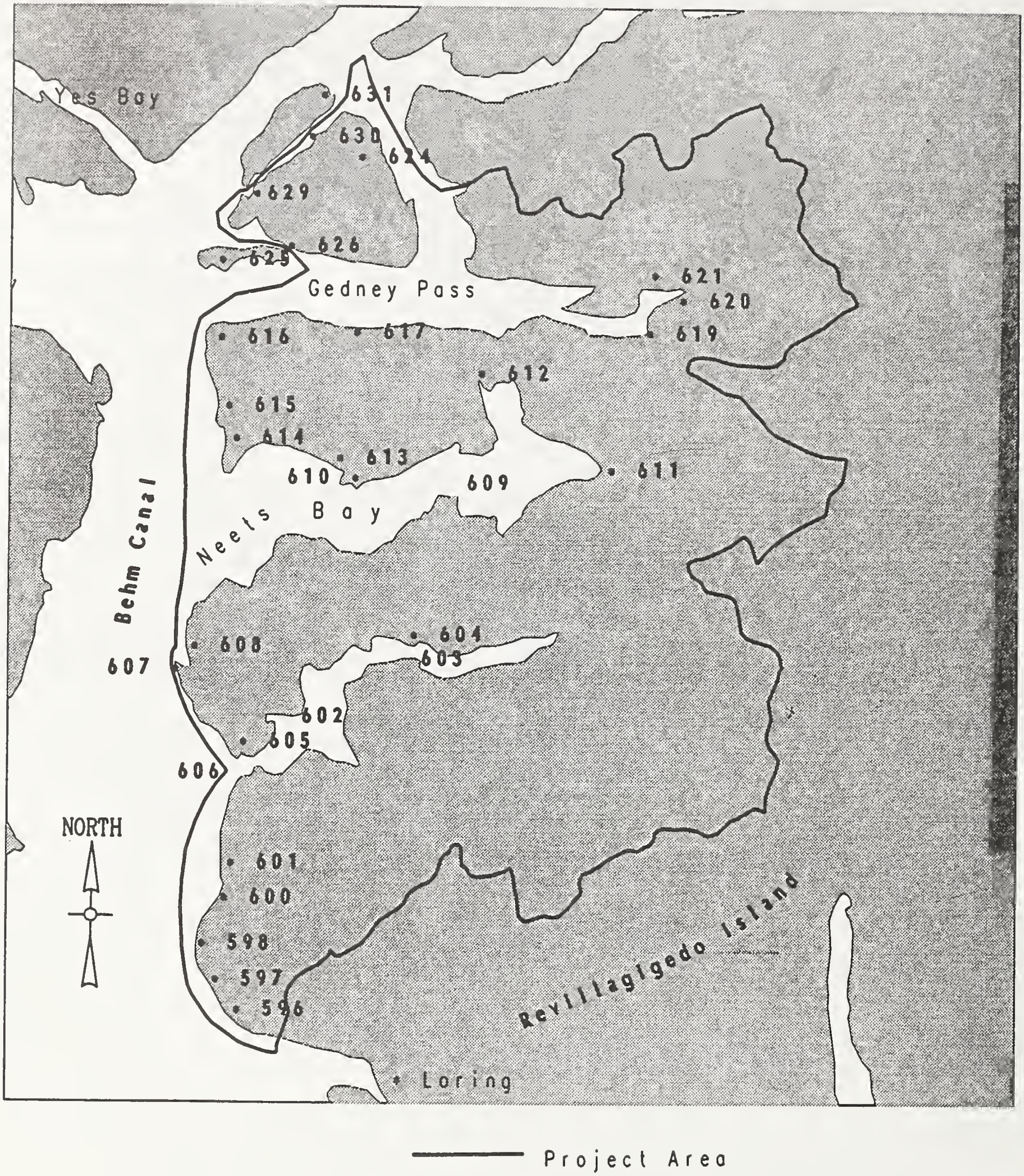
The information gathered from the data search, and literature overview provided information about resource distribution, sensitivity to damage, and management of the resource. However, this work did not provide sufficient information with which to make informed decisions about the potential effects to significant cultural resource sites within the Project Area.

Figure 3-32: LEGEND
Tlingit Place Names for the North Revilla Project Area

No.	Waterman Name	Modern Tlingit Name	Location	Waterman comment
612	Cuquaq	Cuquaq	Small lagoon inside Neets	'Laughing Lagoon' frogs laugh there
618	Gunkceyk	Gunkceyk	Small bay betwn Gedney-Shrimp	'trail end-go over point'
609	Gutinexti	K'wut' inexti	Neets Bay	'sea eggs'
610	Gutinexti kekat	K'wut' inexti kekat	Clam and Bug islands	'island at Nits'
611	Gutinext taheen	K'wut' inext taheen	Neets Creek	'sea eggs creek'
625	Hawieq	Kax weix (high bush)	East on Gedney Island	'red wild currents'
626	Hawieqan	Kax weix.an	West on Gedney Island	camp of #625
620	Kakitaq		Lagoon at Mouth Klu Creek	'dark waterfall lagoon'
617	Kakitcaoiyi		Opp.& Below Hassler Rev side	'dark mountain under'
619	Kaktkas	Kakt x'as	Mouth of Orchard L. drainage	'dark waterfall'
621	Kaskikaan	X'as kika.an	Klam Creek	'waterfall across town'
607	Kelxetciye		Bushy Point	'can see thru'
601	Kiteqiyi	Xatl' geeyi	Francis Cove	'fine grass cove'
606	Knexqkatlak	Kunek kwaakukute	Islands right at mouth Traitors	'Kunex's dry rocks'
596	Kukq		Indian Point	'holes' town used to have totems
603	Kunex		Bay south & opp. #604	
604	Kunexi		Small bay & rocks inside Traitors	'Kunex's tide race'
605	Kunexqkanu		N.point of outer Traitors	'Kunex's mouth fort'
595	Naacasiyi		Just south of Indian Point	'nations out front' many lakes
608	Nelge ic	Gil' tlen (big cliff)	Bushy Point Cove	'big cliff there'
614	Qukwaskagi		Chin Point	'forked point'
598	Tanteyinu	Tan te noowu	Just south of Escape Point	'sea lion rock fort'
600	Tanteyiyeta		Escape Point	'sea lion rock around'
616	Tcitctaiyi		Brown Point	'porpoise on' mountain looks like
622	Tlaxqai	Lax x'ahi	Dress Point	'red cedar point'
624	Tlit	L'eedee (animal tail)	Hassler Island	'tail of animal'
629	Tlittekkanu		Point east side Hassler Island	'tail along side fort'
615	Tsawago	S'awago	Lagoon Near Nose Point	'crab lagoon'
631	Tsidekwdika		N.Lake on Black Island	'narrow place outside'
628	Tsikwenati		South end of Black Island	Tsikwena's town
630	Tskwenikani		On Hassler side Blind Pass	old fish trap area
613	Xekgiyi	Eek geeyi	Small bay past Chin Point	'sandy beach small bay'
597	Xekwatlen	L'eiwatlen/xukwatle	Just north of Indian Point	'big sand'
602	Xuxen		Outer Traitors	

SOURCE: Waterman 1922. Assistance in modern spelling from Tongass Tribe and Ester Shea, July 1993.

Figure 3-32
Tlingit Place Names for the North Revilla Project Area



Survey Strategy in the North Revilla Project Area

The North Revilla inventory strategy involved sampling of the Project Area based on survey that included all proposed project activity areas within the high sensitivity zone and additional areas where traditional subsistence activities and/or other cultural activities/sites were likely to occur. Specific areas of concern included: intertidal areas, beach fringes, riparian zones, resource procurement areas, uplifted fossil beaches, passes or portages, myth and legend sites, karst topography and mineralized zones. A variety of other characteristics were also considered in designing where the surveys were to be conducted, such as, eustacy (changes in sea level) and isostacy (rebounding of the earth's crust since deglaciation), and landform configurations. Because of elevational and sea level changes after deglaciation, the location of the earliest areas of human activity may be further inland and at higher elevations than more recent human activity areas. The environmental characteristics that invited human use and habitation in prehistoric and historic times are often the same factors which invite use today.

Survey consisted of systematic pedestrian inspection of an area, subsurface examination through inspection of rootwads, cutbanks or other natural exposures, and intensive soil probing or supplemental shovel testing as appropriate. This strategy resulted in maximum survey coverage in the areas of highest sensitivity for cultural resources.

In Action Alternatives 2–6, harvest units selected for survey were considered high-probability based on the following criteria:

1) Units with 2 or more acres greater than 100 feet in elevation
2) Units bordered by Class I streams
3) Units adjacent to recorded place name locations
4) Units adjacent to archaeological sites or mines
5) Units in karst areas

Table 3-143 displays the high-probability harvest units surveyed by alternative.

Table 3-143
High Probability Harvest Units Surveyed

Harvest Unit No.	Harvest Unit Acreage	High Prob. Zone Acreage	Alt. No.	Criteria Number
3028	21	21	5	2
3021	66	23	3,6	1
3004	145	43	2	1,2
3037	43	43	4	1,2
3020	73	66	3,4,6	1,2
3027	102	29	5	1,2
5056	51	39	4	1
5047	27	27	5	1
5014	50	50	2	1,3
5046	38	38	5	
5055	39	39	4	1,2,3
5012	11	11	2,5	1,2,3
5029	32	32	3,6	
5001	73	73	2,4,	2
6049	49	49	5	2
6009	61	61	2	2,3,4
6032	65	65	3,6	2,3,4
6025	52	52	3,6	3
6001	24	24	2	3
6033	14	14	5	3
6002	44	44	2,4,5,6	1,3
6026	117	59	3	1,3
6027	37	37	3,5,6	1
6023	10	10	3,6	1
6019	22	22	2	3
7009	45	45	2,4,6	1,2
7014	37	37	2	1,2
7047	50	50	3,5,6	1,2
7013	45	45	2	1,2
7078	16	16	5	1,2
7079	6	6	5	1,2
7005	26	26	2,5	3
7041	26	26	3,6	3
7085	61	26	4	3
8040	103	58	2	1
8079	114	48	3	1
8115	81	9	4	1
8108	34	34	5	1
8082	93	48	6	1
8080	39	39	3,6	1
8117	34	34	4	1
8043	24	24	2	1
8058	15	15	3,6	1
8042	70	70	2	1
8059	51	51	3,6	1
8086	86	70	5	1
9041	19	19	2,3,6	1,2
9085	66	61	5	1
9060	30	30	3,6	1
9029	130	103	2	1
9102	20	20	4	1
9094	55	45	4	1
9018	45	45	2,5	1
9055	80	45	3,6	1
9094	55	10	4	1
9082	30	30	5	1

Results of Cultural Survey

Intensive cultural resources survey conducted during the 1992 field season has resulted in the inspection of 1,518 acres of proposed activity areas and 470 acres of additional areas of high sensitivity representative of all alternatives within the Project Area. These investigations located and documented two previously undiscovered or undocumented cultural resource sites, KET-347 and KET-344. The results of the survey of Waterman Native Place Name locations (see Figure 3-32, earlier in this section) indicates that many of these sites were probably locational names only. At a number of these identified locations, previous disturbance was noted that would in effect have eliminated intact cultural resource remains had they existed. Only one of these locations was associated with cultural remains (KET-344), which may be a coincidental association with the Waterman Place Name. The results of these investigations have been formalized in clearance report documentation and forwarded to the SHPO for review as required by the National Historic Preservation Act and 36 CFR 800. Additional intensive survey efforts, documentation, and SHPO review will be required should proposed activity areas be changed through project redesign, the acquisition of additional pertinent information, or as a result of SHPO comment prior to project implementation.

Specific locational information is protected, to prevent vandalism or unauthorized use of these sites.

Effects of the Alternatives

Direct and Indirect Effects

Types of Potential Impacts

The preservation and protection of cultural resources are closely associated with the location of the resource, the nature of the management activity, and the environmental characteristics where management activities occur. Impacts to the resource may occur from natural forces, from public access, or from project-related activities. Erosion and other environmental effects may also lead to deterioration of cultural resource sites.

Timber harvest activities include the construction and reconstruction of roads, which may lead to an increase in opportunities for public use of cultural resources in the Project Area. Such increased use may enhance understanding of the past—capturing knowledge and information that may disappear over time due to natural decay—and may provide opportunities for interpretation and education. However, public use may destroy cultural resource sites through inadvertent damage caused by compaction or other ground disturbing activities. Vandalism—including relic collecting, defacement, and theft—results in the loss of information and destruction of the resource. Protection of significant cultural resource sites from inappropriate public use includes the establishment of public education programs, maintaining confidentiality about specific site locations, monitoring, and directing public use away from the most vulnerable sites.

Specific North Revilla Potential Impacts

Alternatives 1–6 will result in no effects on cultural resources from the proposed activities, because of avoidance and implementation of proposed management recommendations.

Cultural Resource sites associated with proposed activities have been evaluated for significance through established criteria in 36 CFR 800. Sites KET-347 and KET-344 were determined by this criteria to be eligible for the National Register of Historic Places and have been protected from potential effects of the proposed activities through avoidance, project redesign, and through monitoring during the implementation process.

Recommendations for special management consideration to eliminate potential effects to cultural resource site KET-347 include the elimination of an LTF location in Traitors Cove. KET-344 is located outside of the Project Area and will not be affected by proposed activities. Concern for cultural resource values in these areas established through public comment have reinforced the results of on-the-ground survey and subsequent management recommendations.

SHPO concurrence that there will be no effect to significant cultural resources and clearance for proposed activites is pending.

Cumulative Effects

Impacts from natural decay, landscape changes, private developments, and timber management activities collectively result in the loss of the cultural resources in Southeast Alaska. Development activities of all kinds pose particular threats to cultural resources because such activities tend to be located in the same places that cultural resources are found, such as sheltered coastal settings.

It is impossible to determine the exact nature of resources that may have been previously disturbed in the Project Area. Intensive cultural resource investigations and mitigation measures have been implemented only since the 1980's. The implementation of updated research and survey designs based upon the results of previous work and current methodology and technology, combined with various mitigation measures, will preserve significant sites and provide data that will guide future research and resource management.

RECREATION

Key Terms

Recreation Opportunity Spectrum (ROS) - land delineations that identify a variety of recreation experience opportunities, categorized into six classes ranging from primitive to urban (see ▪ below).

- **Primitive** - A unmodified environment of fairly large size. Interaction between users is very low, and evidence of other users is minimal. The area is essentially free from evidence of human-induced restrictions and controls. Motorized use is not present except for infrequent boats and planes.
- **Semi-Primitive Non-Motorized** - A natural or natural appearing environment of moderate to large size. Concentrations of users is low, but there is often evidence of other users. No roads are present in the area.
- **Semi-Primitive Motorized** - A natural or natural appearing environment of moderate to large size. Interaction between users is low, but there is often evidence of other users. Local roads used for other resource management activities may be present, or along saltwater shorelines there may be extensive motorized boat traffic.
- **Roaded Natural** - A natural appearing environment with moderate evidence of the sights and sounds of humans. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high with evidence of other users prevalent. Motorized use is allowed.
- **Roaded Modified** - A natural environment that has been substantially modified particularly by vegetative manipulation. There is strong evidence of roads and/or highways. Frequency of contact is low to moderate.

Recreation Places - identified geographical areas having one or more physical characteristics that are particularly attractive to people engaging in recreation activities (e.g., beaches, trails, cabins, campgrounds)

Affected Environment

Introduction

The North Revilla Project Area extends north of Naha Bay, along West Behm Canal and north to Hassler Island. The area is indented by prominent bays and long channels generally bounded by steep slopes plunging directly to salt water.

Most of the recreation and tourism use in the Project Area takes place in the saltwater bays and channels within and adjacent to the Project Area including the Orchard Lake area. Just outside the Project Area are saltwater areas used by several resorts. Clients from these resorts engage in boating and fishing activities in waters adjacent to the Project Area. Parts of the Project Area provide the setting for those activities, and are inventoried as Recreation Places.

Current Use

Recreation activities in the Project Area include sportfishing, hunting, camping, hiking, beachcombing, wildlife and scenic viewing, and boating (kayak, canoe, or motorboat). Fishing and hunting occur in areas around Traitors Cove and Neets Bay. Saltwater fishing also occurs in the waters between Bell Island Resort, the northeast corner of Hassler Island, and the mouth of Yes and Spacious Bay in Behm Canal. Many fishing charters use all of these areas.

Recreation cabin use is enjoyed by visitors to Southeast Alaska.

Recreation cabin use is enjoyed by visitors to the Ketchikan Administrative Area. There is a cabin in Blind Pass and two in the Orchard Lake Area. According to Forest Service records, the Blind Pass cabin is one of the more heavily used cabins on the Ketchikan Ranger District. Over the past three years the cabin has been used by an average of 25 parties for 67 days per year. The two Orchard Lake cabins are among the most infrequently used on the Ketchikan Ranger District. The Plenty Cutthroat cabin near the outlet of the lake has been used by an average of nine parties for 27 days per year. The Orchard Lake cabin at the head of the lake has been used by an average of 12 parties for 38 days per year over the past three years. This latter cabin is located outside the Project Area, but would potentially be affected by activities which might occur on the northern slopes above the lake. (See Figure 3-34 for location of these and other recreation areas).

Recreationists also enjoy viewing and hunting wildlife, including big game and waterfowl. Two kayak outfitter guides that have had permits with the Forest Service have identified West Behm Canal, Neets Bay, Traitors Cove and the Hassler Island area as part of their operating area.

Recreation Demand

Information about public demand for various recreation opportunities within the Project Area come from three sources—the Alaska Public Survey of 1979, an Alaska Department of Fish and Game (ADF&G) survey in 1989 of businesses and groups that discuss nonconsumptive uses of wildlife (e.g., wildlife viewing, photography), and the Ketchikan Community Survey of 1990.

Naturalness and remoteness associated with marine and freshwater recreation places were rated as "very important" by 80–90 percent of the recreation users of the Tongass National Forest. When asked about sensitivity to change, natural-appearing settings and solitude are the most important attributes (Clark and Johnson 1981). A sizeable number of Alaska residents indicate that they would stop going to their favorite places if development-related activities occurred on the site (Alaska Public Survey 1979).

The ADF&G survey related to wildlife viewing also indicated that those people engaged in this activity were concerned that various development activities such as logging, remote homesites, small aircraft use, and fish farming all could adversely affect the quality of the wildlife viewing experience.

Southeast Alaska residents highly value opportunities for remote, uncrowded outdoor recreation. At the same time, community access is important to those wanting to do more hunting, fishing and beachcombing. In particular, Ketchikan residents want to see an expansion of the road system on Revilla Island primarily for the purpose of expanding roaded recreation opportunities (Ketchikan Community Survey 1990). Development of new hiking trails and bicycle paths are the most desired opportunities.

Recreation Opportunity Spectrum (ROS)

The process used to classify recreation opportunities on National Forest System lands is the Recreation Opportunity Spectrum (ROS). The ROS system portrays a range of recreation activities, settings, and experiences from primitive to urban. Opportunities in the various classes depend on a variety of factors including: access, facilities present, amount of modification to the natural landscape, and the opportunity for solitude. Figure 3-33 illustrates the ROS classes inventoried within the Project Area. A summary of the existing acreages by ROS class is displayed in Table 3-144 Sixty-one percent of the North Revilla Project Area is currently inventoried as Roaded Modified.

Table 3-144

Existing Recreation Opportunity Spectrum (ROS) Classes in Acres

ROS Class	Acres
P	13,964
SPNM	29,269
SPM	586
RN	1,902
RM	63,809
Total	109,530

SOURCE: Short, 1992

Most of the area inside Traitors Cove, Margaret Lake area, and most of Neets Bay has an ROS class of Roaded Modified. A network of roads access these areas but are not linked to any road system from Ketchikan. Almost all of the Primitive ROS classes are on the north half of Hassler Island, and in the Orchard Lake drainage. A few small areas of Primitive are found on the edge of the Project Area; these are part of larger Primitive areas outside the Project Area.

Figure 3-33
Inventoried ROS Classes

Recreation Places

A Recreation Place is identified as a geographic area having one or more physical characteristics attractive to people engaging in recreation activities. These places may be beaches, waterfalls, stream, lakes, scenic features, bays, anchorages, existing and potential recreation sites, and trails. Each Recreation Place has some activity associated with it such as hiking, camping, hunting, or viewing scenery or wildlife. These Recreation Places define the inventoried recreation areas which are important for existing and potential recreation uses.

There are 17 Recreation Places identified within the Project Area. Figure 3-34 displays the Recreation Places and their associated ROS class.

Table 3-145 shows the Recreation Places within the Project Area including the number of acres, the ROS class, the existing and potential recreation sites and activities, the current TLMP (1979a, as amended) LUD's, and the proposed TLMP Revision (1991a) LUD's.

Figure 3-34
Recreation Places and their ROS Class

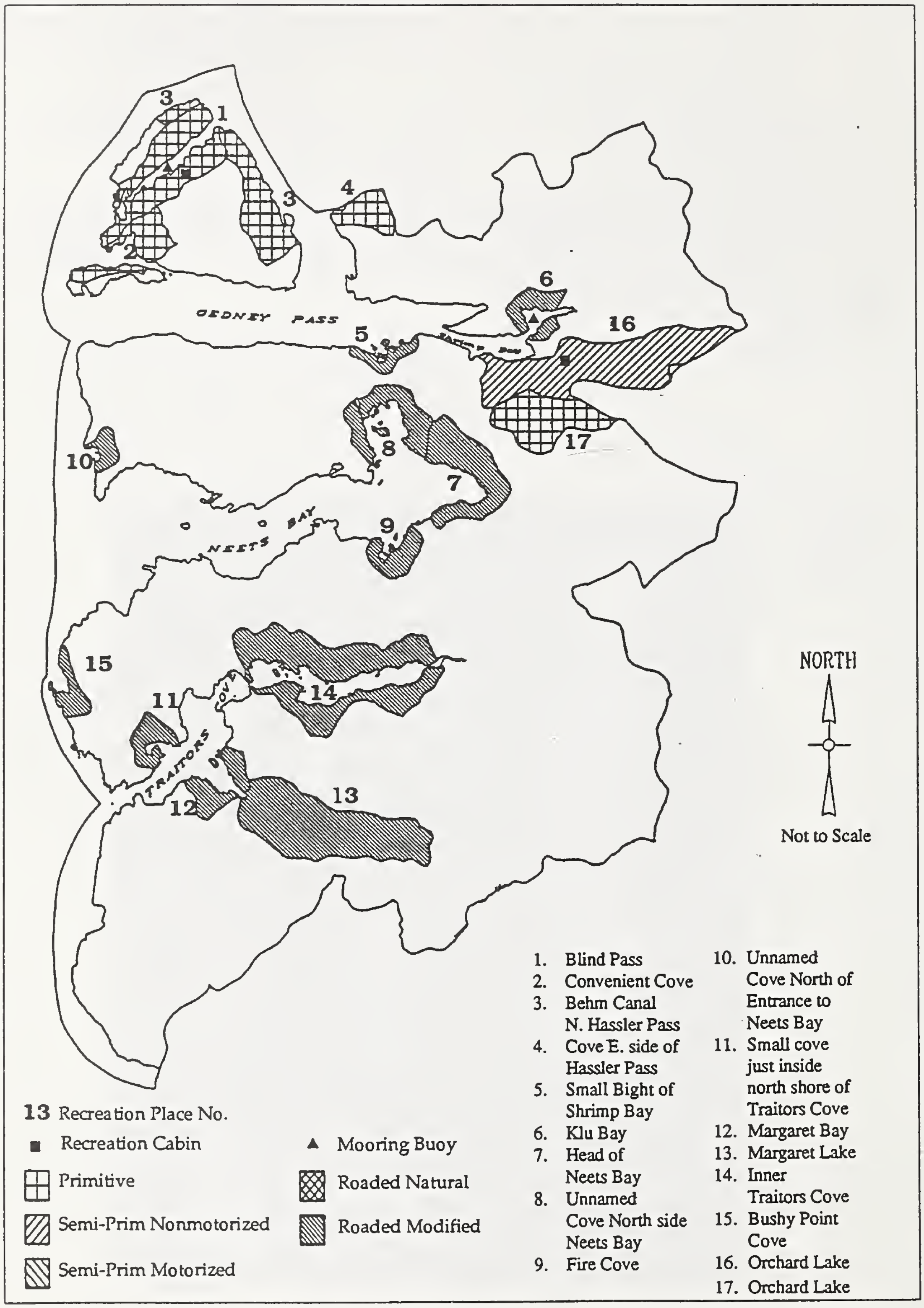


Table 3-145
Recreation Places within the North Revilla Project Area

Area	Recreation Place	Acres	ROS	Recreation Activities	Recreation Sites	Current TLMP LUD's	TLMP Rev. Prescription
Hassler	1. Blind Pass	1,658	P	boating, saltwater fishing, hiking, lake fishing (1)	existing cabin, buoy, anchorage	LUD III	Scenic Viewshed
	2. Convenient Cove	723	P	boating	anchorage	LUD III	Scenic Viewshed
	3. Behm Canal N. Hassler Pass	1,326	P	boating, saltwater fishing		LUD III	Scenic Viewshed
	4. Cove E. side of Hassler Pass	507	RM	boating, camping	anchorage, potential buoy site & cabin	LUD III	Modified Landscape
Gedney Pass	5. Small bight of Shrimp Bay	301	RM	boating, saltwater fishing	cabin*	LUD III	Modified Landscape
	6. Klu Bay	498	RM	boating	anchorage	LUD III	Modified
Neets Bay	7. Head of Neets Bay	1,284	RM	boating, saltwater fishing (2)	anchorage	LUD IV	Modified Landscape
	8. Unnamed Cove Northside Neets Bay	916	RM	boating, saltwater fishing	anchorage	LUD IV	Modified Landscape
	9. Fire Cove	468	RM	boating	anchorage	LUD IV	Modified
	10. Unnamed Cove North of Entrance to Neets Bay	239	RM	boating	anchorage (limited)	LUD IV	Modified Landscape
Traitors Cove	11. Small cove just inside north shore Traitors Cove	429	RM	boating	anchorage	LUD IV	Timber Production
	12. Margaret Bay	564	RM	boating	anchorage	LUD IV	Timber Production
	13. Margaret Lake	2,923	RM	big game hunting, lake fishing,	trail hiking	LUD IV	Timber Production
	14. Inner Traitors Cove	3,010	RM	waterfowl hunting, viewing scenery, beachcombing	dispersed campsite	LUD III	Modified Landscape
Behm Canal	15. Bushy Point Cove	361	SPM	viewing scenery, beachcombing, dispersed camping, boating	dispersed campsite, anchorage	LUD IV	Modified Landscape

— more —

Table 3-145 — continued
Recreation Places within the North Revilla Project Area

Area	Recreation Place	Acres	ROS	Recreation Activities	Recreation Sites	Current TLMP LUD's	TLMP Rev. Prescription
Orchard Lake	16. Orchard Lake (3)	3,059	SPNM	hiking, wildlife and scenic viewing, lake fishing	trail, Plenty Cutthroat Cabin	LUD III	Semi-Primitive Recreation
	17. Orchard Lake (3)	1,347	P	hiking, wildlife and scenic viewing lake fishing	Orchard Lake Cabin, potential trail	LUD III & IV	Semi-Primitive Recreation

SOURCE: Short, 1992
(1) Inland from Blind Pass, less than a half mile above the recreation cabin is a small lake that provides recreation opportunities. There is an undeveloped trail from the recreation cabin to this lake. There is also potential to access this lake with a trail from the logging roads proposed in this area.
(2) Inland from the head of Neets Bay are Bluff Lake and Neets Lake. These areas could provide opportunities for roaded recreation if new harvest in the area opens up the old roads and additional new roads, and if these roads are located and designed to provide access to these lakes. These roads could serve as hiking or mountain bike trails to these lakes and be accessed by boat from the head of Neets Bay.
(3) Most of the SPNM portion of the Orchard Lake recreation place is within the Project Area. Most of the Primitive portion of this recreation place (primarily at the head of the lake) is actually outside the Project Area. The Orchard Lake cabin is in the P portion outside the Project Area. A potential trail opportunity along Orchard Creek upstream from this cabin is identified in the Forest recreation inventory.
* Potential

Recreation Places Outside the North Revilla Project Area

Bell Island Resort is located approximately 2.5 miles across a wide expanse of Behm Canal from the northeast corner of Hassler Island. Sport fishing by the resort's clientele takes place throughout this area where several channels come together. Additional timber harvest in the area will be visible from fishing areas around the Bell Island Resort, and therefore will change the natural setting for sport-fishing in this area.

Yes Bay Lodge is located approximately 3 miles inside Yes Bay from Behm Canal. Yes Bay Lodge clients sport fish in Behm Canal, along the northeast shore of Spacious Bay and the bays and channels within the Project Area. Timber harvest on the west side of Hassler Island will be visible from these fishing areas, and alter the natural setting experienced by visitors to this area.

North End Clover Pass–Betton Island. Extensive sportfishing takes place in this area by Ketchikan residents and clientele of the Clover Pass Resort, Salmon Falls Resort, and Silver Bright Lodge. Timber harvest from the Indian Point to Traitors Cove area would potentially create additional visual impacts to those already present for people using the waters inside Clover Pass, out in Behm Canal and the outer portion of Naha Bay. Extensive dispersed recreation use on the west and north sides of Betton Island may also occur.

Effects of the Alternatives

Recreation Opportunity Spectrum (ROS)

With the exception of two areas, the action alternatives will not substantially change the ROS classes. The primitive area of Hassler Island is roaded and harvested to different degrees by each of the alternatives, changing the ROS class. Alternatives 2 and 5 enter the additional portions of the Klu Bay drainage and change the ROS class from primitive and semi-primitive non-motorized to roaded modified and semi-primitive non-motorized.

Most of the remaining proposed harvest in these action alternatives occurs in areas classified as roaded modified due to harvest within the past 30 years, or in semi-primitive non-motorized areas immediately adjacent to these roaded modified areas. These semi-primitive areas will change to roaded modified. In a few places the new road networks and harvest extends near the Project Area boundary with the Naha River and Carroll Creek drainages. In these locations small primitive areas within these drainages change to semi-primitive non-motorized.

None of the alternatives enter the Orchard Lake and Orchard Creek drainage.

Misty Fiords National Monument will not be affected by any of the proposed alternatives of this EIS.

Table 3-146 displays the ROS class distribution by alternative. Primitive acreages represent areas just inside the Project Area boundary that are part of larger primitive areas outside the Project Area.

Table 3-146
ROS Class Acres Distribution by Alternative

Alternative	RM	RN	SPM	SPNM	P
1	63,799	1,902	586	29,269	13,964
2	79,404	1,391	339	26,147	2,247
3	71,015	3,344	339	29,804	5,028
4	75,989	1,447	339	27,364	4,144
5	75,587	681	339	28,493	4,429
6	73,202	1,336	339	29,347	5,058

SOURCE: Short, 1992
RM = Roaded Modified, RN = Roaded Natural, SPM = Semi-primitive Motorized, SPNM = Semi-primitive Non-motorized, P = Primitive

Use and Demand

Future recreation use and demand in the Project Area are not expected to change with implementation of any of the alternatives. Existing recreation activities and patterns are associated with a combination of natural and roaded settings. The action alternatives generally add to existing road networks with some exceptions.

As recreation settings change, recreationists will have several options. Some will find the conversion of some areas to roaded settings unacceptable and will either cease their activity or be displaced to other areas such as the Naha or Cleveland Peninsula. Some recreationists will adapt to the changes in the settings and continue to pursue traditional activities in the Project Area. Others may substitute their activities with opportunities associated with the new settings. Consequently, the use patterns are expected to change slightly.

Impacts of Alternatives on Recreation Places

Alternative 1

The Recreation Places on Hassler Island and around Orchard Lake will maintain their primitive setting. The other Recreation Places within the Project Area which are now roaded modified will continue to move toward the semi-primitive setting as second growth continues to mature and old roads are overtaken by first alder, then gradually spruce, hemlock or cedar.

Alternative 2

Blind Pass (No. 1) Units 5501 and 5502 along the south side of Blind Pass will be evident from some viewpoints in Blind Pass. During development activity, road construction and logging will be clearly audible to users of the cabin. This will include the visual and auditory evidence of helicopters for a period of a few weeks. South of the cabin this area will change to a roaded modified class. The rest of the area bordering Blind Pass—along the Hassler shore north of the cabin, and across the pass on Black Island—remains unroaded, but changes to a semi-primitive non-motorized class because of the proximity of the new roads and units. Harvest unit 5002 is located almost directly behind the Blind Pass cabin. This unit will not be visible from the cabin, but could affect the integrity of the site, particularly if blowdown begins to occur along the edge of this unit.

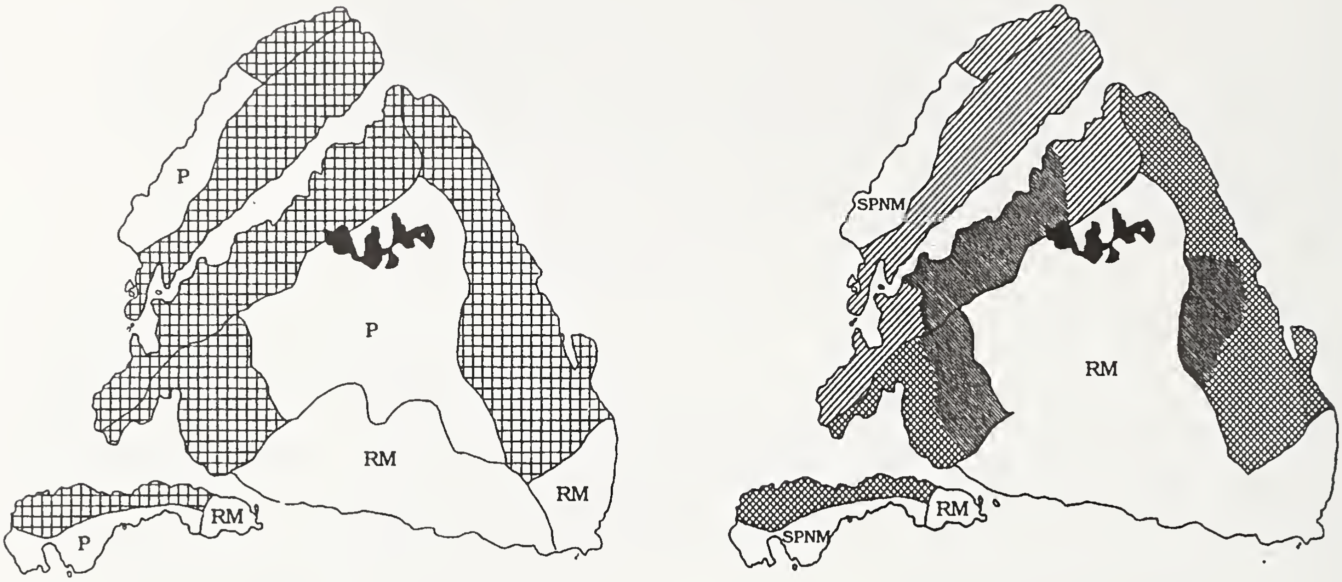
Convenient Cove (No. 2) Units 5006, 5007, 5008, and 5009 about one-half mile back from the shore of this cove will change a portion of this recreation place to roaded modified. However this harvest will only be slightly visible from the anchorage. The area immediately around the cove will change to a roaded natural setting. Logging and road construction activity, including helicopters, will be audible to those anchored in this cove.

Behm Canal–North Hassler Pass–Unnamed Cove E. Side of Hassler Pass (Nos. 3 & 4) This discussion combines two Recreation Places which consist of the slopes along north Hassler Pass and near where Behm Canal and Behm Narrows converge, and around Bell Island Resort. It also includes a small cove on the east side of Hassler Pass opposite the old LFT on Hassler Island. The harvest and roading in this alternative along the east side of Hassler Island facing Hassler Pass will have slight to moderated visual impacts. Hence this area will change to roaded natural. The inland portion of the recreation place will change to roaded modified. (See the Visual Resource section for a more detailed analysis of visual impacts in these areas.)

Road construction and logging activity, including helicopters, will be audible from North Hassler Pass. The slopes on the Revilla side of this channel (outside the Project Area) will change to semi-primitive non-motorized. The cove on the east side of Hassler will remain roaded modified.

Figures 3-35 through 3-39 illustrates the changes in recreation settings (ROS class) on Hassler Island. Other recreation places are not illustrated because there are no substantial changes to the recreation settings (ROS classes) in these areas. These maps also compare Alternative 1, the existing condition, with the proposed action.

Figure 3-35
Alternative 2 Changes in Recreation Opportunities on Hassler Island



Existing 1993

Recreation Opportunities for Alt 2

- Semi-Primitive Motorized
- Roaded Natural
- Roaded Modified
- Primitive
- Semi-Primitive Nonmotorized
- Lakes

Shaded areas are recreation places.
ROS class of unshaded areas is indicated on Map.

Remaining Recreation Places. The remaining Recreation Places described in the affected environment section are in a roaded modified setting due to old harvest units and road networks (ranging from 10 to 30 years old). All these Recreation Places are in Klu Bay, Gedney Pass, Neets Bay, and Traitors Cove. The alternatives introduce various levels of new harvest and roading in these roaded modified Recreation Places, but do not change ROS classes.

In Alternative 2, three of these Recreation Places are not affected by harvest within their boundaries. The small cove off Behm Canal north of the entrance to Neets Bay (No. 10), and Bushy Point Cove (No. 15) will have minimal visual impacts from new harvest within their boundaries. (Units 6001 and 6002 in no. 10 and units 8048, 8049 and 8050 in no. 15). The sounds of road building and timber harvest will be clearly audible and change the recreation setting from these anchorages while timber harvest operations occur. No harvest is planned near the small cove inside Traitors Cove.

In Recreation Places that have been harvested and/or roaded, different levels of new harvest will be introduced that will create moderate levels of visual impacts. In two areas, including the head of Neets Bay and the inner part of Traitors Cove, where no harvest or road-building activity has occurred within the Recreation Place in the past 10 to 20 years, the proposed new harvest and road construction will generate sounds that will change the recreation setting for those who have been using these saltwater areas during the past decade. (This new harvest includes units 7036, 7037, 7038, 7039, and 7022 at the head of Neets Bay, and units 9002, 9003, 9004, 9005, 9008, 9009, 9042, 9043, 9044, 9045 and 9047 in the inner portion of Traitors Cove).

Impacts to Areas Outside the Project Area. During harvest activities on Hassler Island, Bell Island Resort guests will hear and see some evidence of logging from the resort and from the waters to the west of the the resort. This harvest will create moderate visual impacts from these waters.

Yes Bay Lodge guests using the waters at the mouth of Yes Bay and into Behm Canal will hear and see evidence of logging on Hassler Island. This harvest will create moderate visual impacts from these waters.

From Clover Pass and the resorts in this area there will be no additional evidence of logging.

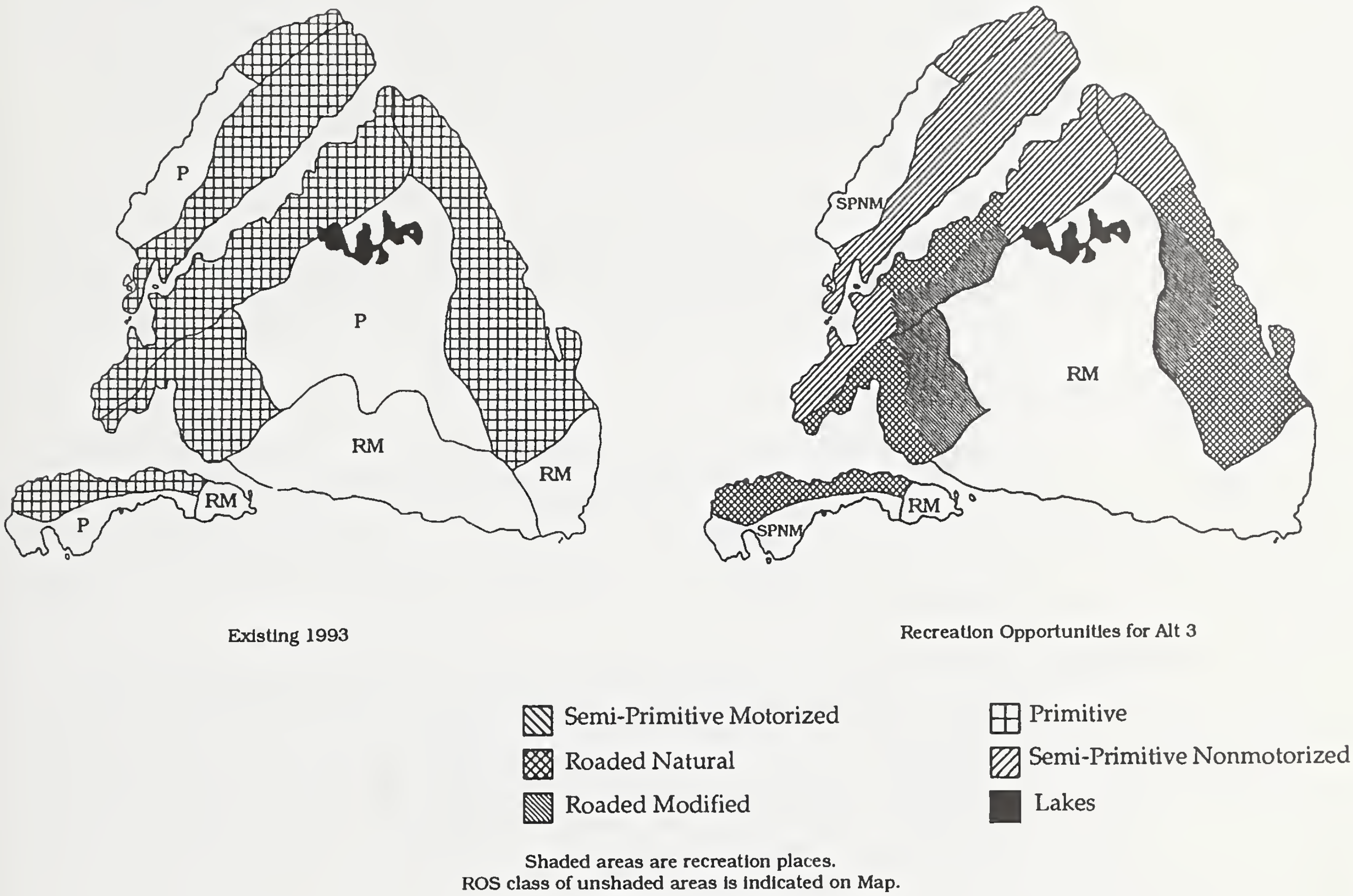
Alternative 3

Blind Pass (No. 1). This alternative affects a small portion of this Primitive Recreation Place with two units (5501 and 5560) located in this area from one-eighth to one-quarter mile back from the shore. This alternative includes no units directly affecting the recreation cabin on Blind Pass. A small portion of this area around the roads and harvest unit will change to a roaded modified class. The area along the shore south of the cabin will change to a roaded natural setting, while the rest of the area will change to semi-primitive non-motorized. Road construction and harvest activity, including helicopter activity, will be audible from the cabin.

Convenient Cove (No. 2). Impacts to this anchorage are similar to Alternative 2. Two units (5024 and 5008) over one-half mile back from the shore will change some of the area to roaded modified. The sounds of harvest activity will be evident, but the visual impacts of the harvest will be minimal as seen from the anchorage. The area immediately around this cove will change to a roaded natural setting.

Behm Canal–North Hassler Pass–Unnamed Cove, E. Side of Hassler Pass (Nos. 3 and 4). The Hassler Island side of Hassler Pass will will change from a primitive ROS class. Three units, 5026, 5029, and 5030 create slight to moderate visual impacts. Part of the area will change to roaded natural along the shore and roaded modified back from the shore. The northern end of Hassler Pass facing Bell Island Resort does not include any harvest. This area will change to semi-primitive non-motorized. As with Alternative 2, the small cove on the east side of the pass, which is already roaded modified, will be affected by harvest that will be seen on the southeast corner of Hassler Island.

Figure 3-36
Alternative 3 Changes in Recreation Opportunities on Hassler Island



Remaining Recreation Places. Impacts to most of the remaining Recreation Places which are all presently roaded modified, are slightly less than in Alternative 2 due to the smaller scale of harvest within these areas. The one exception is the small cove north of the entrance to Neets Bay where the harvest (units 6025 and 6026) is slightly more extensive than in Alternative 2. The head of Neets Bay includes no new units or roads, thereby maintaining the present setting and allowing further regeneration of the old harvest within or near this area. Therefore, the recreation setting is not significantly changed in most of these areas except for a slight increase in visual impacts.

Impacts to Areas Outside the Project Area. Impacts to the recreation setting around the Bell Island Resort and the mouth of Yes Bay will be less than Alternative 2 because of the slightly smaller scale of harvest on Hassler Island. There will be no additional impacts to the Clover Pass area and the resorts within this area.

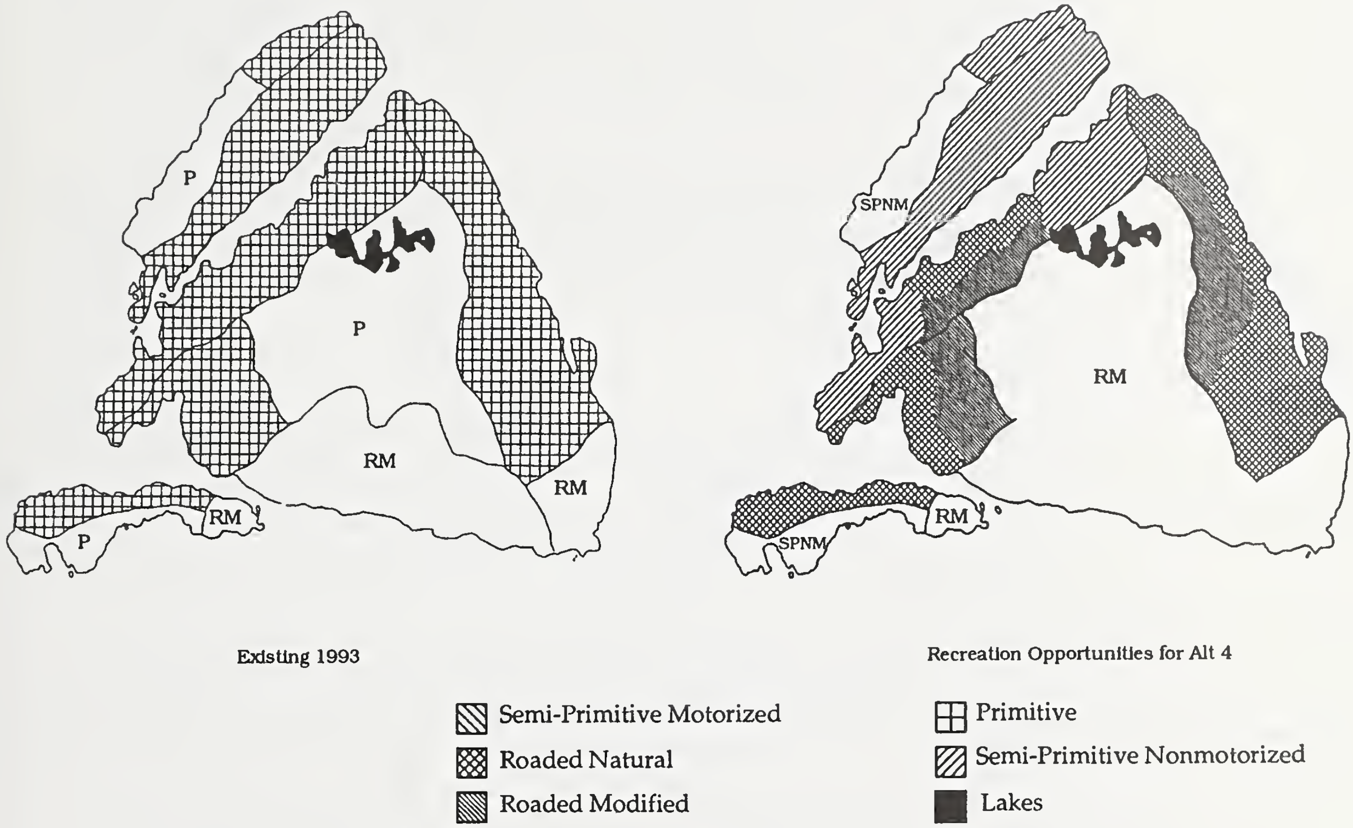
Alternative 4

Blind Pass (No. 1). Recreation impacts to the Blind Pass area are similar to those from Alternative 2 except that no unit is proposed in this alternative directly behind the Blind Pass cabin that would potentially impact the integrity of this site.

Convenient Cove (No. 2). Units proposed in this alternative are the same as same as Alternative 2.

Behm Canal–North Hassler Pass–Unnamed Cove E. Side of Hassler Pass (Nos. 3 and 4). Impacts to this waterway are slightly less in this alternative than Alternative 2 due to a smaller level of harvest at the northern end of this pass. The ROS class of this area changes to roaded natural along the west shore of Hassler Pass and roaded modified back from the shore. The opposite side of the channel (outside the Project Area) changes to semi-primitive non-motorized. The setting of the cove on the east side of Hassler Pass remains roaded modified.

Figure 3-37
Alternative 4 Changes in Recreation Opportunities on Hassler Island



Shaded areas are recreation places.
ROS class of unshaded areas is indicated on Map.

Remaining Recreation Places. Most of the remaining roaded modified Recreation Places in the Project Area include a few new units and small additions to the road network in these areas creating relatively small changes to the recreation setting. These include unit 3006 in Klu Bay, units 7066, 7037, and 7056 at the head of Neets Bay, and units 9000, 9048, 9052, 9054, 9104, and 9103 in the head portion of Traitors Cove. Three places — the small cove just east of Shrimp Bay, Bushy Point Cove, and the small cove just inside Traitors Cove — are not affected directly by any new harvest or roads within their boundaries.

Impacts to Places Outside the Project Area. Impacts to the recreation setting around the Bell Island Resort and the mouth of Yes Bay will be similar to those from Alternative 2 due to the slightly smaller scale of harvest in this alternative in the areas seen from these waters. There will be no additional impacts to the Clover Pass area and the resorts within this area.

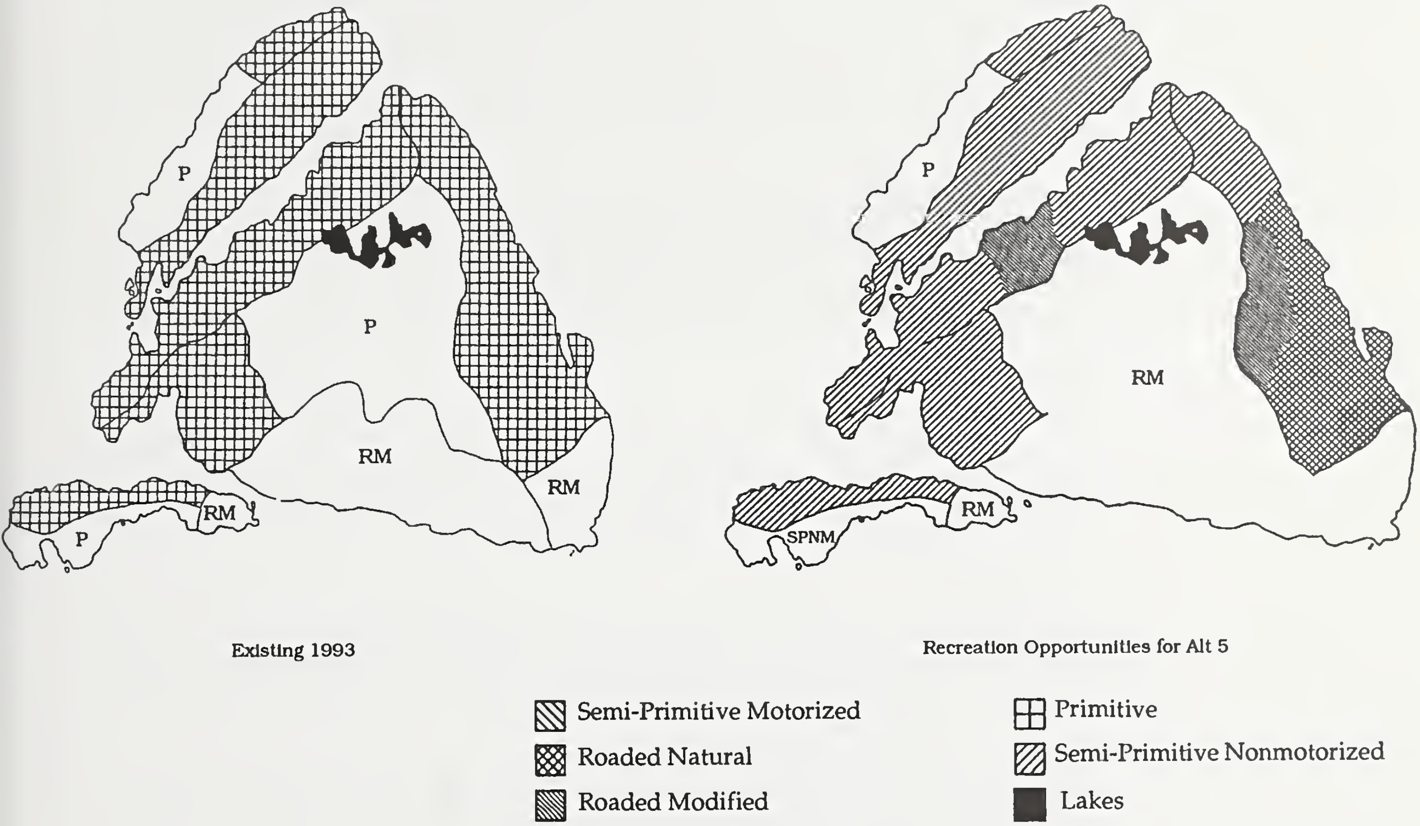
Alternative 5

Blind Pass. No harvest is proposed within this primitive recreation place except for one unit on the slopes behind thecabin which will change the setting of this portion of the place to roaded modified. The rest of the place will change to semi-primitive non-motorized due to the proximity of the harvest and roading in the center of the island. As with other alternatives, road construction and logging will be audible from the cabin, but for a shorter period of time.

Convenient Cove. No harvest is proposed within this place in this alternative. However the area will change to semi-primitive non-motorized due to the proximity of harvest on the rest of the island. Road construction and logging will be audible to some degree from within the cove.

Behm Canal–North Hassler Pass–Unnamed Cove E. Side of Hassler Pass. Because visual impacts in this area are substantially less than from Alternative 2, impacts to the setting are less. The southern two-thirds of the Hassler Island side of the pass changes to roaded natural and roaded modified while the northern end changes to semi-primitive non-motorized. The east side of the pass will also change to semi-primitive non-motorized. The cove on the east side of the pass remains roaded-modified.

Figure 3-38
Alternative 5 Changes in Recreation Opportunities on Hassler Island



Shaded areas are recreation places.
ROS class of unshaded areas is indicated on Map.

Remaining Recreation Places. Impacts in this alternative are similar to those in Alternative 2. All the remaining roaded modified Recreation Places will have small to moderate levels of new harvest except the cove on the south shore of Gedney Pass just west of Shrimp Bay. No harvest or roads are proposed within this area. In these other roaded modified Recreation Places the recreation setting does not change appreciably. In Bushy Point Cove, and the small cove just north of the entrance to Neets Bay, which have had no previous harvest in them, a few units will create light to moderate visual impacts from the coves. These include unit 8082 in Bushy Point and units 6002, 6033, and 6034 in the cove north of the entrance to Neets Bay.

Impacts to Areas Outside the Project Area. The impacts to the recreation setting around Bell Island Resort and the mouth of Yes Bay will be somewhat less than those from other alternatives because of the minimal visual impacts. There will be no additional impacts to Clover Pass and the resorts in this area.

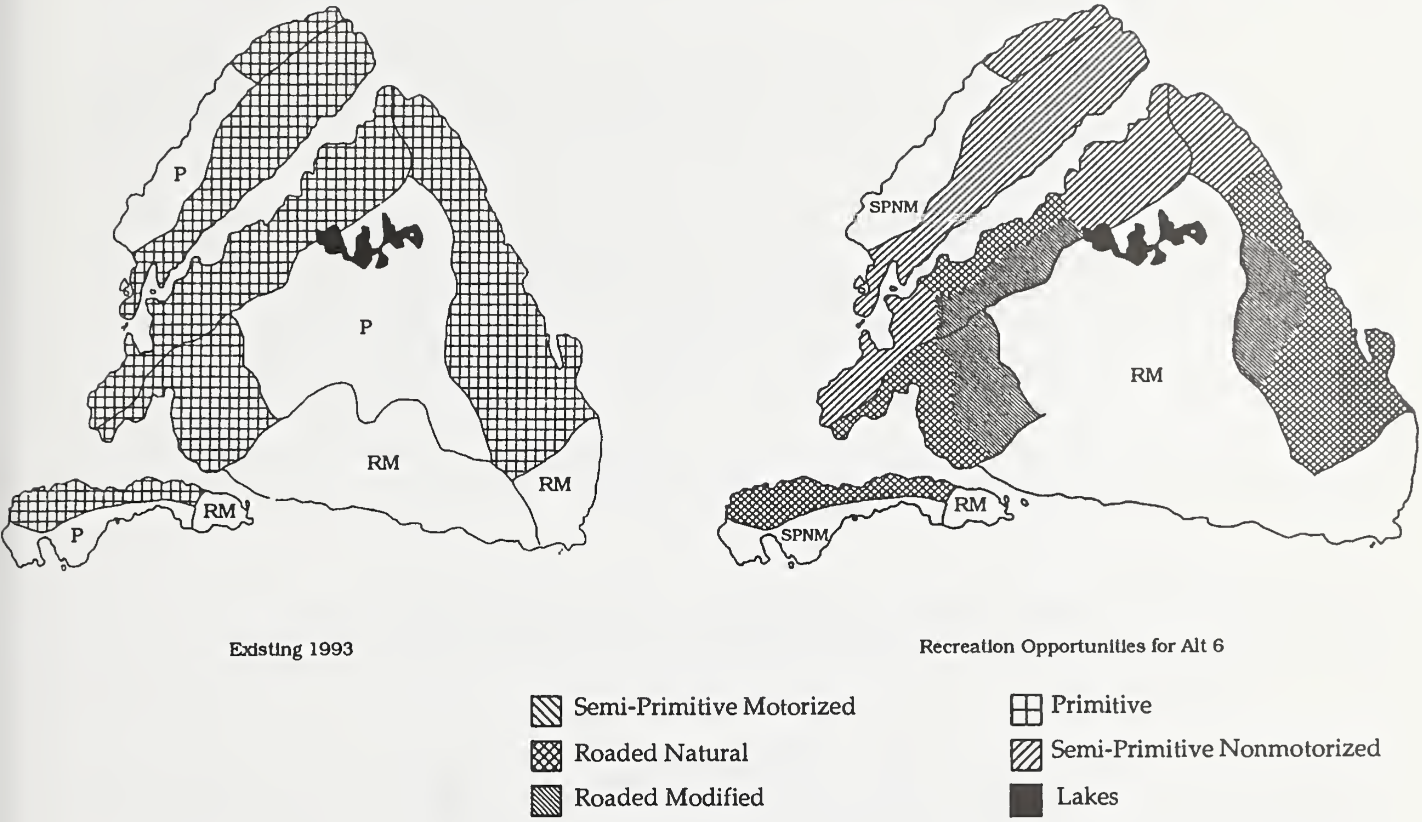
Alternative 6

Blind Pass. The impacts to this primitive recreation place arevery similar to those from Alternative 3. The shoreline south of the cabin will change to a roaded natural setting, while the area back from the shore will change to roaded modified. The northern end of this pass and the opposite shore will change to semi-primitive non-motorized.

Convenient Cove. Impacts to this cove are the same as from Alternative 2, 3 and 4. The area will change to roaded natural around the cove and roaded modified inland. While timber harvest activities will be audible from the cove, visual impacts as seen from the cove will be minimal.

Behm Canal–North Hassler Pass–Unnamed Cove E. Side of Hassler Pass. Impacts along North Hassler Pass are very similar to Alternative 3. The northern end of the pass will change to semi-primitive non-motorized while the rest of the pass to the south will change to roaded modified and roaded natural.

Figure 3-39
Alternative 6 Changes in Recreation Opportunities on Hassler Island



Shaded areas are recreation places.
ROS class of unshaded areas is indicated on Map.

Remaining Recreation Places. Impacts in the remaining roaded modified Recreation Places are identical to those from Alternative 3 except that a few additional helicopter units on the slopes back from the head of Inner Traitors Cove will add slightly to the visual impact from the cove.

Impacts to Areas Outside the Project Area. Impacts to the recreation setting around the Bell Island Resort and mouth of Yes Bay will be almost identical to those from Alternative 3. There will be no additional impacts to Clover Pass and the resorts in this area.

Cumulative Effects

By the year 2140 the recreation settings in the Project Area will move towards an emphasis on roaded modified and roaded natural ROS classes with the exception of the Orchard Lake area. Existing recreation place settings will reflect this change, and new recreation opportunities associated with roads will likely emerge. Recreation users with high expectations for natural appearing settings will have adapted to the changing conditions, or have been displaced to other areas on the Forest, or will choose to no longer recreate on the Forest. Displacement to other natural areas may result in increased use, social encounters, and a reduction in the opportunities for solitude in those places. These changes are consistent with the analysis and projections in the TLMP Revision SDEIS.

Wild and Scenic Rivers: Affected Environment

Rivers on the Tongass National Forest were evaluated in the TLMP Revision as to their eligibility for the National Wild and Scenic Rivers System. To be eligible a river must be free-flowing, and contain at least one "outstandingly remarkable value." One river in the Project Area—Orchard Creek and Lake—was found eligible for a classification of "wild". The river was further studied as to its suitability for inclusion in the National System in the TLMP Revision SDEIS, Appendix E. The river was not recommended for inclusion to the National Forest System in Alternative P of the TLMP Revision.

Wild and Scenic Rivers: Effects of Alternatives

None of the alternatives affect the eligibility of Orchard Creek and Lake for consideration as a Wild and Scenic River. The potential Wild River classification would remain.

ROADLESS AREAS

Affected Environment

The North Revilla Project Area includes portions of the North Revilla (526), the North Cleveland (529) and all of the Neets (527) Roadless Areas, as identified in the TLMP Draft Revision, Alternative P (1991a). This analysis evaluates the direct and indirect effects the alternatives may have on the roadless character and wilderness attributes of the three areas.

In addition to this EIS, there are three future EIS's on the Forest Plan activity schedule that could affect the roadless areas during the next 5-10 years: Vixen Inlet, Port Stewart, and Upper Carroll Creek (See Appendix A).

Roadless Areas are defined as an area in a national forest or national grassland that meet minimum Wilderness criteria, as defined by the 1964 Wilderness Act. These are roadless areas that have been identified in the TLMP Revision planning process and not by the Roadless Area Review and Evaluation II (RARE II) process.

The minimum criteria for considering a roadless area in the evaluation of Wilderness potential was established by the Wilderness Act of 1964 and in subsequent regulation and policies. To qualify, an area must contain at least 5,000 acres of undeveloped land which does not contain improved roads maintained for travel by passenger-type vehicles. However, areas less than 5,000 acres may qualify if they are a self-contained ecosystem such as an island, are contiguous to existing wilderness, or are ecologically isolated by topography and manageable in a natural condition.

Roadless Areas are described in Appendix C of the TLMP Revision (1991a). Roadless areas within the North Revilla Project Area are described below.

North Revilla Roadless Area No. 526

The North Revilla Roadless Area totals 158,831 acres of which 50,461 are within the Project Area. This roadless acreage includes most of the upper portions of the Margaret Creek, Traitors River, Neets Creek, and Klu Bay drainages; these have all been extensively roaded and harvested. These remaining unroaded portions of these drainages consist of very steep, rugged terrain with many V-notches and slide paths. These unroaded areas because of their small size and fragmented nature do not meet criteria for consideration for wilderness. However, they are contiguous with either the Misty Fiords National Monument Wilderness to the east of the Naha River legislated LUD II to the south.

One drainage that remains entirely roadless is the western and northern portions of the Orchard Lake watershed. There are portions of this drainage that are outside of the Project Area but remain part of the North Revilla Roadless Area. This area meets the criteria to become considered for recommendation as a Wilderness area because of

its intact natural integrity, high scenic quality, and high quality primitive recreation opportunities.

Three other drainages—Naha River, Carroll Creek, and the Long Lake/Behm Narrows drainages—are inside the North Revilla Roadless Area and outside the Project Area.

North Cleveland Roadless Area No. 529

The North Cleveland Roadless Area totals 112,775 acres of which 4,618 acres are within The Project Area. Hassler Island (with the exception of some past harvest areas on the southern and southeastern shores of the island) is included within the North Cleveland Roadless Area boundaries. Hassler Island is a small part of the North Cleveland Roadless Area which primarily encompasses the rugged mainland terrain from Yes Bay and McDonald Lake to Anchor Pass. This island is characterized by a few rounded ridges extending up to 2,000 feet. There are some steep slopes on the south shore and lower gentler ridges along the other sides of the island. Some opportunities exist for solitude, particularly in the Blind Pass and Convenient Cove areas. Small lakes just above the Forest Service recreation cabin in Blind Pass may have recreation opportunities. Hassler Island by itself does not have the opportunities for solitude, and the more primitive recreation opportunities that the mainland portion of this roadless area does because it is a small island surrounded by nearby resorts and by waterways that are frequented by boaters and fishermen during many parts of the summer.

Neets Roadless Area No. 527

The Neets Roadless Area is 6,315 acres and is entirely within the Project Area. The area has moderately steep, uniform, timbered slopes, and ridgetops. The ROS system inventories this area as semi-primitive non-motorized, and there are no inventoried recreation attractions and opportunities. There are limited opportunities for primitive recreation experiences due to the areas small size, proximity to extensively harvested areas, and road networks. The area is surrounded by timber.harvest. Because of these factors it does not meet the criteria for consideration for Wilderness.

Figure 3-40 displays the roadless areas within the Project Area.

Figure 3-40
Revilla Project Area Roadless Areas

The Project Area includes portions of the North Revilla (526), the North Cleveland (529) and all of the Neets (527) Roadless Areas.

Effects of the Alternatives

All action alternatives would affect the roadless character and roadless attributes of the Project Area to varying degrees.

In all alternatives timber harvest and road construction would directly and indirectly affect the Margaret Creek, Traitors River, and Klu Bay portion of the North Revilla Roadless Area (No. 526). None of the alternatives propose any road construction or timber harvest in the Orchard Lake and Creek drainage. All action alternatives reduce by slightly different degrees the Hassler Island portion of the North Cleveland Roadless Area (No. 529).

The following discussion below summarizes the areas where the alternatives differ as to their effects on roadless acreage.

In the Klam Creek drainage (VCU 732) Alternatives 2 and 5 propose roading and several units several miles up into this drainage thereby reducing the roadless acreage in this portion of the North Revilla Roadless Area. Alternatives 3, 4 and 6 propose no roading and harvest in this drainage.

In the Neets Creek drainage, which is already roaded by past harvest, Alternatives 2, 4 and 5 propose additional roading and harvest on the higher slopes of this valley, thus decreasing slightly the roadless acreage remaining in this portion of the North Revilla Roadless Area. Alternatives 3 and 6 propose no additional harvest in this drainage.

Table 3-147 displays by alternative the number of roadless acres remaining in each roadless area by within the Project Area.

Table 3-147
Remaining Acres of Roadless Areas within the Project Area by Alternative

Alternative	North Revilla 526	North Cleveland 529	Neets 527
1	50,461	4,618	6,315
2	37,933	2,298	5,113
3	43,930	3,508	5,404
4	39,588	4,354	4,731
5	37,997	4,404	5,334
6	42,256	4,603	5,071

Alternatives 2–6 all reduce the roadless acres within the North Revilla area by 6,531 to 12,682 acres. These reductions are all in drainages that are already logged and roaded. They do not affect the potential for wilderness designation for the other drainages in this Roadless Area (Naha River, Orchard Lake & Creek, Carroll Creek, and the Long Lake-Behm Narrows area) outside the Project Area.

Alternatives 2–6 all reduce the roadless acres within the North Cleveland area by 1,073 to 2,320 acres. These reductions are all on Hassler Island. The potential for wilderness consideration for this island is lost in all action alternatives. However these alternatives do not affect the potential for Wilderness consideration for the rest of the North Cleveland Roadless Area that is outside the Project Area.

Alternatives 2–6 all reduce acres in the Neets Roadless Area. The reduction in roadless acres will range from 981 acres in Alternative 3 to 1,584 acres in Alternative 4. The potential for Wilderness designation, which was low to begin with, is essentially gone.

Cumulative Effects

By the year 2140 there will be few roadless areas remaining in the Project Area except for the Orchard Lake area and the upper parts of the drainages and ridges that cannot be logged due to physical limitations. Potential harvest and roading activity in the upper Carroll Creek drainage may reduce the size of this portion of the North Revilla Roadless Area.

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VISUAL RESOURCES

Key Terms

Background - the distant part of a landscape; the seen, or viewed, area located from 3–5 miles to infinity from the viewer
Cumulative Visual Disturbance (CVD) - the accumulated percent of a viewshed's seen area in a disturbed condition at any one point in time
Existing Visual Condition (EVC) - the level of visual quality or condition. presently occurring on the ground
Foreground - the detailed landscape found within 0 to 1/4–1/2 mile from observer
Future Visual Condition (FVC) - the level of visual quality or condition occurring on the ground at the end of the proposed harvest period
Middleground - the space between foreground and background in a picture or landscape. The area located from 1/4–1/2 to 3–5 miles from the viewer
Perspective View - the landscape as seen by an observer from a viewpoint; measurements are three-dimensional (height, width, and depth)
Planimetric View - the landscape as viewed from space or plan-view; measurements are two-dimensional (width and length)
Rehabilitation - a short term management alternative used to return existing visual impacts in the natural landscape to a desired visual quality
Sensitivity Level - the measure of people's concern for scenic quality; three levels are assigned to land areas viewed from boat routes, anchorages, plane routes, roads, trails, public-use areas, and recreation cabins
Viewframe - the viewed landscape as defined by the visual scene which the eye focuses on; similar to a landscape photograph
Viewshed - the seen, or viewed, area from one or more viewpoints as defined by multiple viewframes; as seen from a road, marine waterway, or specific viewpoint
Visual Absorption Capacity (VAC) - an estimate of the relative ability of a landscape to absorb management activities
Visual Quality Objective (VQO) - a measurable standard reflecting five different degrees of acceptable landscape alteration based on a landscape's diversity of natural features and the public's concern for high scenic quality

- **Preservation** - permits ecological changes only; applies to wilderness areas and other special classified areas
- **Retention** - in general, management activities are not evident to the casual forest visitor
- **Partial Retention** - in general, management activities may be evident but must remain subordinate to the characteristic landscape
- **Modification** - management activities may dominate the characteristic landscape but must, at the same time, utilize naturally established form, line, color, and texture. It should appear as a natural occurrence when viewed in foreground or middleground
- **Maximum Modification** - management activities may dominate the characteristic landscape but should appear as a natural occurrence when viewed as background

Introduction

An important aspect of Southeast Alaska's natural resource base is its attractive setting. The importance of this scenic splendor of the area is evident by increased tourism and a heightened awareness of and sensitivity to scenic resource values by Alaska's residents (Monaco, 1992). The Visual Resource Management (VRM) system, developed by the Forest Service, inventories these scenic resources and provides measurable standards for their management.

Visual Resource Management is the management of the "seen" aspects of both land and the activities which occur upon it. It involves inventory, analysis, and determination of objectives (or standards) for those environmental aspects which are evaluated by sense of sight.

The VRM system is a two-part analytic process. The first part assesses the relative scenic quality (Visual Character Type and Variety Class) of the Project Area as found in its current natural state. The second part assesses viewer sensitivity levels based on type and use of these landscapes.

Scenic quality and sensitivity levels are combined to establish a set of Visual Quality Objectives (VQO's).

The following discussion applies the VRM System to the North Revilla Project Area.

Visual Character Type

Visual Character Type describes a large area of land that has common characteristics of landform, rock formations, water forms, and vegetative patterns. The Project Area is located in terrain referred to as Coastal Hill (TLMP, 1979a). The terrain in the Project Area consists of deeply dissected blocks of high mountains 2-3 miles across, separated by deep fjords or straits one-half to 3 miles wide. The closely spaced mountainous peninsulas and islands (Hassler Island) are under 3,500-feet elevation. Generally, steep landforms to salt water and an irregular rounded appearance are characteristic.

The terrain in the Project Area is typical of coastal hill landscape.

Scenic Quality

The first step in the landscape analysis process assesses the relative scenic quality of all landscapes in the analysis area as they are found in their natural state. These landscapes are rated as having either distinctive, average, or low scenic quality (Landscape Variety Class-A, B or C, respectively). Landscapes ranking high in visual value are usually those of above-average variety. These ratings are based on the degree of diversity in the physical features and are rated relative to the overall character of the larger region, the Coastal Hill Character Type.

Mostly Class-B landscapes are found within the Project Area, although two areas, the Orchard Lake waterfalls and the inner portion of Traitors Cove (beyond a salt chuck), rate as Class-A, or distinctive, within the context of this project area.

Sensitivity Levels Inventory

The second part of the landscape analysis identifies recreation use areas, communities, travel routes (marine and land), anchorages and cabins, and their associated viewsheds. These visually sensitive areas are based on their type and frequency of use, and range from Sensitivity Level I to Level III.

A Sensitivity Level I is assigned to viewsheds associated with heavily used recreation areas and major marine travel routes. Sensitivity Level II is assigned to areas such as less frequently used boat routes, roads, anchorages, salt water fishing areas, and their viewsheds. Sensitivity Level III applies to all land areas not seen from any of the Level I or II travel route or use areas.

The key sensitive use areas within the Project Area are classified into two categories:

1. Salt water - The entire West Behm Canal from the Clover Pass area near Ketchikan northward to beyond Bell Island is classified as Sensitivity Level 1, as is the Blind Pass cabin and its anchorage. This corridor is used extensively by local sport/commercial fishing boats as well as cruise ships and charters to and from Misty Fiord National Monument, Silver Bright Lodge, Yes Bay Lodge, and Bell Island Resort. Salt water bays and inlets such as Traitors Cove, Inner Neets Bay, Gedney Pass, Klu Bay, and Shrimp Bay with its anchorage are rated Sensitivity Level II.

2. Inland Cabin Lakes - Orchard Lake, with two Forest Service cabins, and the surrounding drainage basin are rated as Sensitivity Level I.

Visual Quality Objectives (VQO's)

VQO's are a set of measurable goals for management of visual resources on National Forest System lands. They are benchmark guidelines for management direction and are based on the evaluation of landscape variety classes, viewer sensitivity levels, distance zones (see Key Terms for foreground, middleground, and background), and management goals .

The VQO's describe different degrees of acceptable alteration of the natural landscape. They include Preservation (P), Retention (R), Partial Retention (PR), Modification (M), and Maximum Modification (MM) and are defined in Key Terms. Hypothetical examples and relationships are shown in Figure 3-41.

Existing and Future Visual Condition

As part of the planning process for the North Revilla Project Area, a detailed visual analysis has been completed. Field visits, topographic map analyses, and computer-generated perspective views or plots were used to determine the visual impacts of the various alternatives. All seen or viewed areas in the Project Area were digitized; natural openings and existing harvest areas were plotted; and computerized terrain and view models were created for each viewpoint. All VCU's were analyzed except VCU 732 (not seen from salt water).

Existing Visual Condition (EVC) represents the level of visual quality or condition presently occurring on the ground. Similarly, Future Visual Condition (FVC) represents the visual condition level that would occur at the end of a proposed activity period. Both are measured in terms of condition types as described below. Existing and future visual condition levels may also be described in terms similar to those used to describe VQO's (see Figure 3-41).

Type I	**Natural Condition** Areas in which only ecological change has taken place. Corresponds to the Preservation VQO.
Type II	**Natural Appearing** Areas in which changes in the landscape are not noticed by the average forest visitor unless pointed out. Corresponds to the Retention VQO.
Type III	**Slightly Altered** Areas in which changes in the landscape are noticed, but do not attract attention. Corresponds to the Partial Retention VQO.
Type IV	**Moderately Altered** Areas in which changes in the landscape are easily noticed and may attract attention. Corresponds to the Modification VQO.
Type V	**Heavily Altered** Areas in which changes in the landscape obviously appear to be major disturbances and stand out as a dominating impression of the landscape. Corresponds to the Maximum Modification VQO.
Type VI	**Drastically altered** Areas in which changes in the landscape are in glaring contrast to a natural appearance. Not a VQO; an unacceptable visual condition.

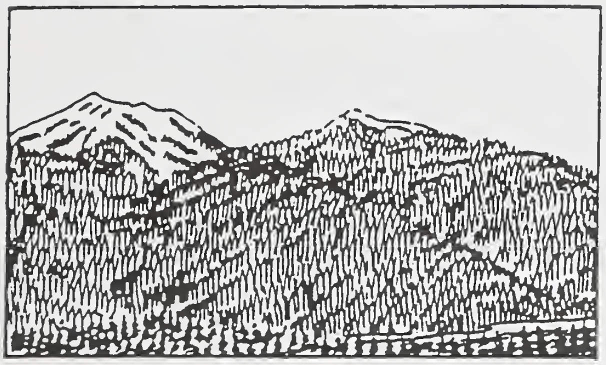
The EVC benchmark inventory can be used to: 1) compare a viewshed's actual condition (current degree of alteration) with a project's proposed VQO's, 2) assess cumulative visual impacts of alternatives, and 3) determine whether the proposed management activities or facilities will maintain or change the present conditions, lower the visual quality, or meet/not meet a project's proposed VQO's.

Figure 3-41, on the next page, illustrates the relationship between VQO's and visual condition.

Figure 3-41
Relationship between VQO's and Visual Condition

VQO of Preservation
VC I - Natural Condition

Changes are predominantly ecological.

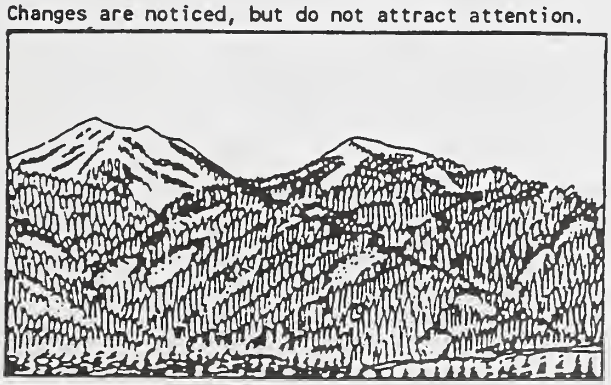


VQO of Retention
VC II - Natural Appearing

Changes are not evident to casual visitor.

VQO of Partial Retention
VC III - Slightly Altered

Changes are noticed, but do not attract attention.

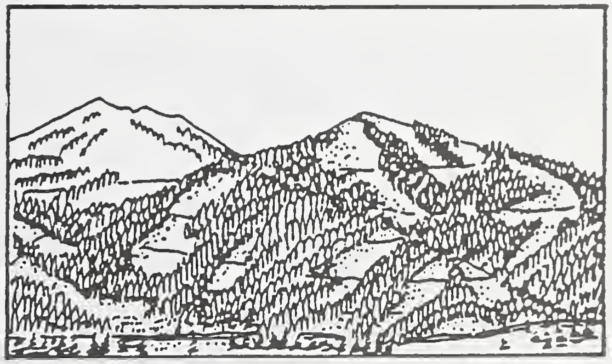


VQO of Modification
VC IV - Moderately Altered

Changes are easily noticed and attract attention.

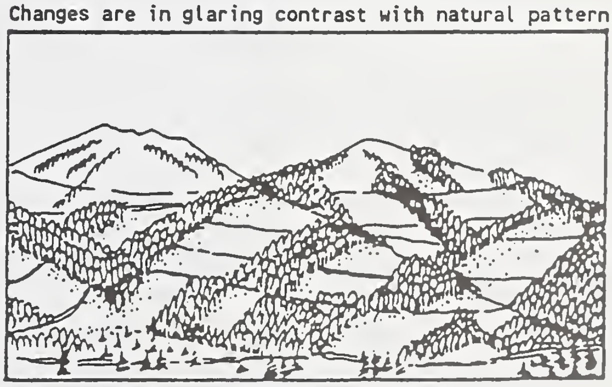
VQO of Maximum Modification
VC V - Heavily altered

Changes are very dominant and attract attention.



Unacceptable Modification
VC VI - Drastically altered

Changes are in glaring contrast with natural pattern



Affected Environment

Project Area Viewsheds

Viewsheds differ from watersheds or VCU's in that viewshed boundariesare defined only by visually seen areas as viewed from representative viewpoints. Since the primary viewing platform in the Project Area is from salt water, these sample viewpoints are positioned a minimum of one half mile from the shoreline. Typically, the foreground distance zone is composed of beach fringe vegetation which acts to screen some landscape from view.

To assess the potential visual impacts of the different alternatives in relation to this EIS's proposed VQO's, a set of travel routes and use areas considered important (corresponds to Sensitivity Level I and II areas) to the North Revilla Project Area and their associated viewsheds has been identified. These priority travel routes and use areas are:

West Behm Canal	Gedney Pass	Neets Bay
North Behm Canal	Shrimp Bay	Orchard Lake
Traitors Cove	Klu Bay	Hassler Pass

The associated viewsheds are divided into three categories based on their present visual condition: (1) heavily altered, (2) moderately altered, and (3) slightly altered.

Table 3-148 lists each viewshed by category and displays the percentage of current visual disturbance (alteration). Locations of these viewsheds are indicated by viewpoint direction symbols in Figure 3-42.

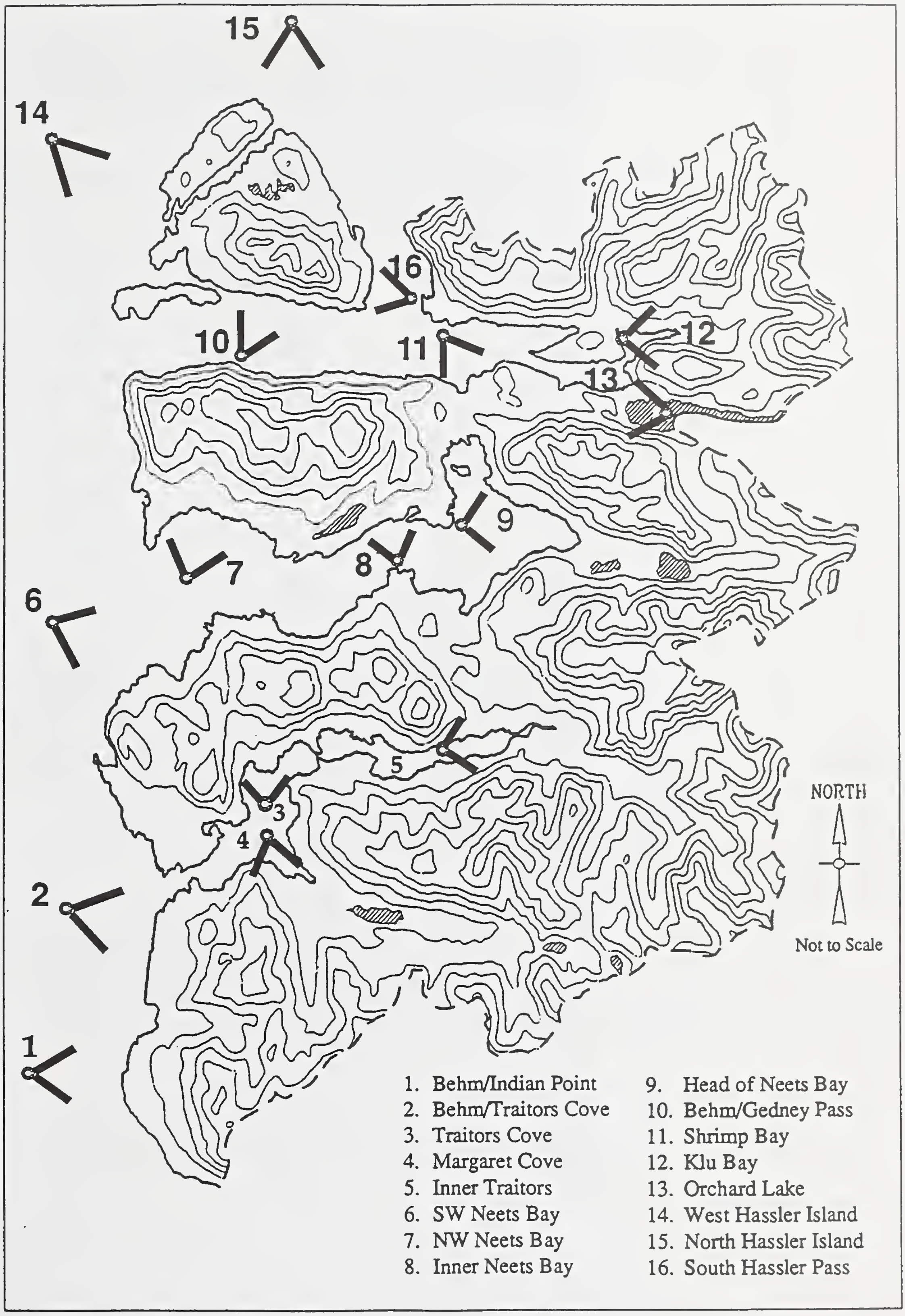
Table 3-148
Project Area Viewsheds, by Name and Percent Altered

Heavily Altered	Moderately Altered	Unaltered to Slightly Altered
1. Behm/Indian Point (11%)	3. Traitors Cove (5%)	13. Orchard Lake (0%)
2. Behm/Traitors Cove (9%)	4. Margaret Cove (1%)	14. Behm/W.Hassler (1%)
6. Behm/SW Neets Bay (20%)	5. Inner Traitors (9%)	15. Behm/N.Hassler (0%)
	7. Behm/NW Neets Bay (8%)	16. S. Hassler Pass (0%)
	9. Head of Neets Bay (1%)	
	10. Behm/Gedney Pass (6%)	
	11. Shrimp Bay (5%)	
	12. Klu Bay (4%)	

SOURCE: Angelus, 1993 and Ketchikan Area Visual Resource Inventory

Over 100 viewpoints (ground level and aerial) have been established for analysis in this EIS, of which only 16 have been selected for display (one for each associated viewshed) and are illustrated in Figure 3-42 on the following page.

Figure 3-42
Sample Viewpoints of Project Area Location Map



Project Area VQO's

Each viewshed's existing visual condition (EVC) and proposed VQO's are compared in Table 3-149. These proposed VQO's are consistent with those proposed in the TLMP Revision (1991a).

Table 3-149
Comparison of Visual Condition and Proposed VQO's by Viewshed

Viewshed Name	Existing Visual Condition	Corresponds To	Proposed VQO's (FG-MG)
Behm/Indian Point	III-V	PR-MM	PR-M
Behm/Traitors Cove	III-IV	PR-M	PR-M
Traitors Cove	III-IV	PR-M	M-MM
Margaret Cove	III	PR	M-MM
Inner Traitors	I-IV	R-M	PR-M
Behm/SW Neets Bay	III-V	PR-MM	PR-M
Behm/NW Neets Bay	III	PR	PR-M
Inner Neets Bay	III-IV	PR-M	M-MM
Head of Neets Bay	III-IV	PR-M	PR-M
Behm/Gedney Pass	III-IV	PR-M	PR-M
Shrimp Bay	II-IV	R-M	PR-M
Klu Bay	I-IV	R-M	PR-M
Orchard Lake	I	R	PR-PR
Behm/West Hassler	I-II	R	R-PR
Behm/North Hassler	I	R	R-PR
South Hassler Pass	II	R	PR-M

Notes: FG = Foreground; MG = Middleground; R = Retention VQO; PR = Partial Retention VQO; M = Modification VQO; MM = Maximum Modification VQO; FG = Foreground; MG = Middleground
All viewsheds are viewed from 1/4 to 1/2 mile from salt water shorelines, except the Orchard Lake viewshed, which is viewed from the centerline of the lake.
There are no background views within these viewsheds. All unseen areas (none within these viewsheds) are proposed to be managed for the Maximum Modification VQO.
SOURCE: Angelus, 1993

Nearly 19 percent of the viewsheds have been harvested since 1942. Although the majority of second growth is 20–30 years old and 25–50 feet high, it is still visible when viewed as middleground due to variations in topography, harvest unit shape and location, and mature-stand backline edge contrasts. Vegetation texture and color differences account for definitive visual separations as well.

Table 3-150 displays the inventory and proposed VQO's for each viewshed.

Following this table are two maps on facing pages, Figure 3-43 and Figure 3-44, that illustrate the changes between Inventory VQO's and Proposed VQO's for the Project Area.

Table 3-150
Inventory and Proposed VQO's, in Seen Acres

Viewsheds	Size	Type	Visual Quality Objective (VQO) R	PR	M	MM
Behm/Indian	2,036	Inventory	899	1,137	0	0
		Proposed	0	899	1,137	0
Behm/Traitors	4,079	Inventory	902	2,940	237	0
		Proposed	0	1,073	3,006	0
Traitors Cove	2,714	Inventory	0	1,410	1,304	0
		Proposed	0	141	1,019	1,554
Margaret Cove	2,021	Inventory	0	583	1,438	0
		Proposed	0	0	1,207	814
Inner Traitor	8,078	Inventory	0	3,429	4,649	0
		Proposed	0	3,429	4,649	0
Behm/SW Neets	2,114	Inventory	200	1,914	0	0
		Proposed	0	620	1,494	0
Behm/NW Neets	5,256	Inventory	713	2,608	1,935	0
		Proposed	0	1,097	2,101	2,058
Inner Neets	3,834	Inventory	0	1,272	2,562	0
		Proposed	0	0	1,255	2,579
Head of Neets	6,036	Inventory	0	2,952	3,084	0
		Proposed	0	2,936	3,100	0
Behm/Gedney	4,018	Inventory	45	3,164	809	0
		Proposed	0	2,809	1,209	0
Shrimp Bay	3,812	Inventory	0	2,038	1,774	0
		Proposed	0	2,498	1,314	0
Klu Bay	2,473	Inventory	0	1,059	1,219	195
		Proposed	0	1,048	1,425	0
Orchard Lake	3,464	Inventory	1,587	1,223	654	0
		Proposed	0	3,464	0	0
Behm/W.Hasslr	1,695	Inventory	497	1,198	0	0
		Proposed	732	963	0	0
Behm/N.Hasslr	1,316	Inventory	438	845	0	33
		Proposed	492	824	0	0
Hassler Pass	574	Inventory	0	360	214	0
		Proposed	0	116	458	0
Viewshed Totals	53,520	Inventory	5,281	28,132	19,878	228
		Proposed	1,224	21,917	23,374	7,005
% Change from inventory			- 77%	- 22%	+ 15%	+ 97%

SOURCE: Angelus, 1993

Figure 3-43
North Revilla Project Area Inventory VQO's

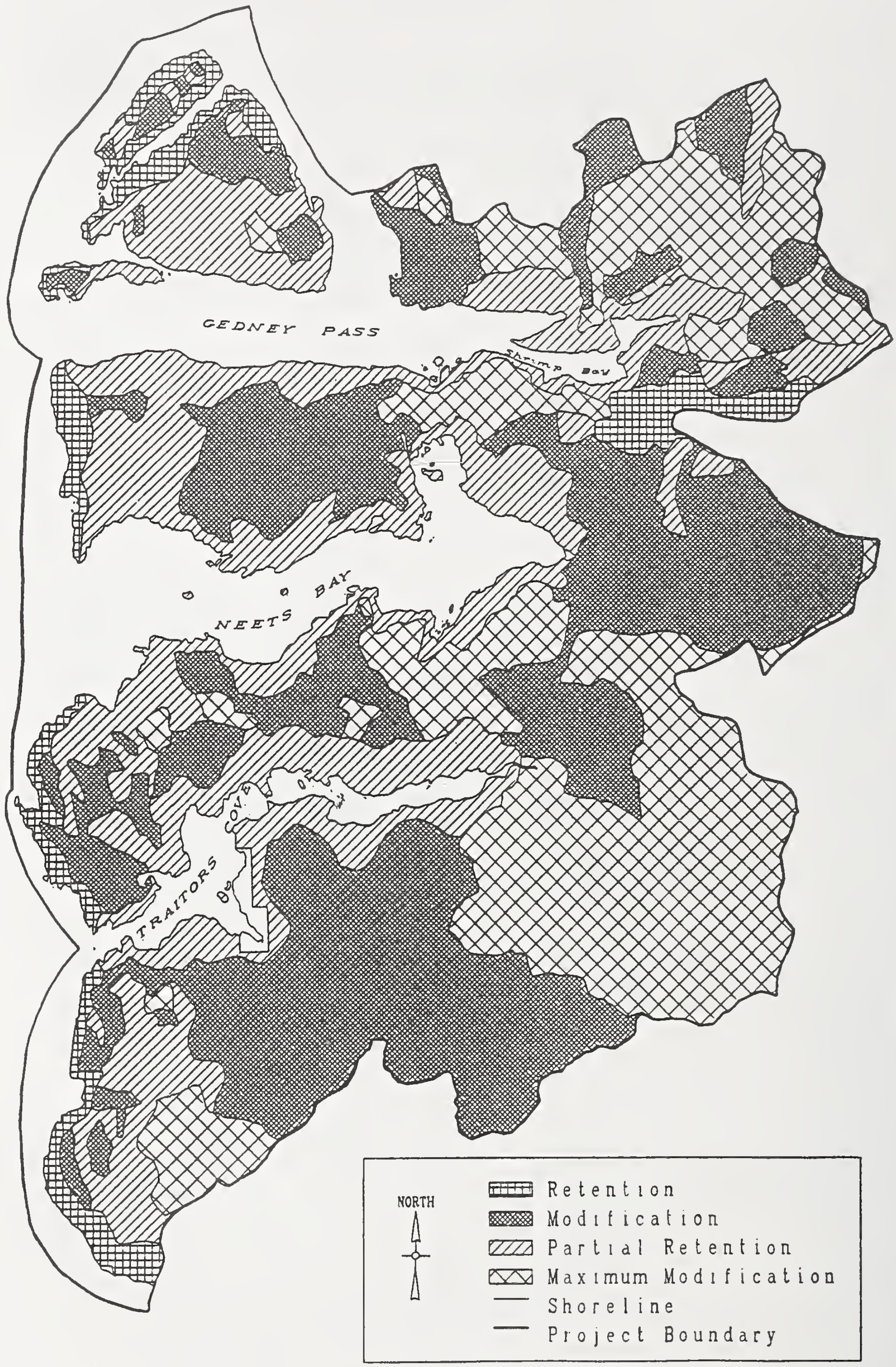
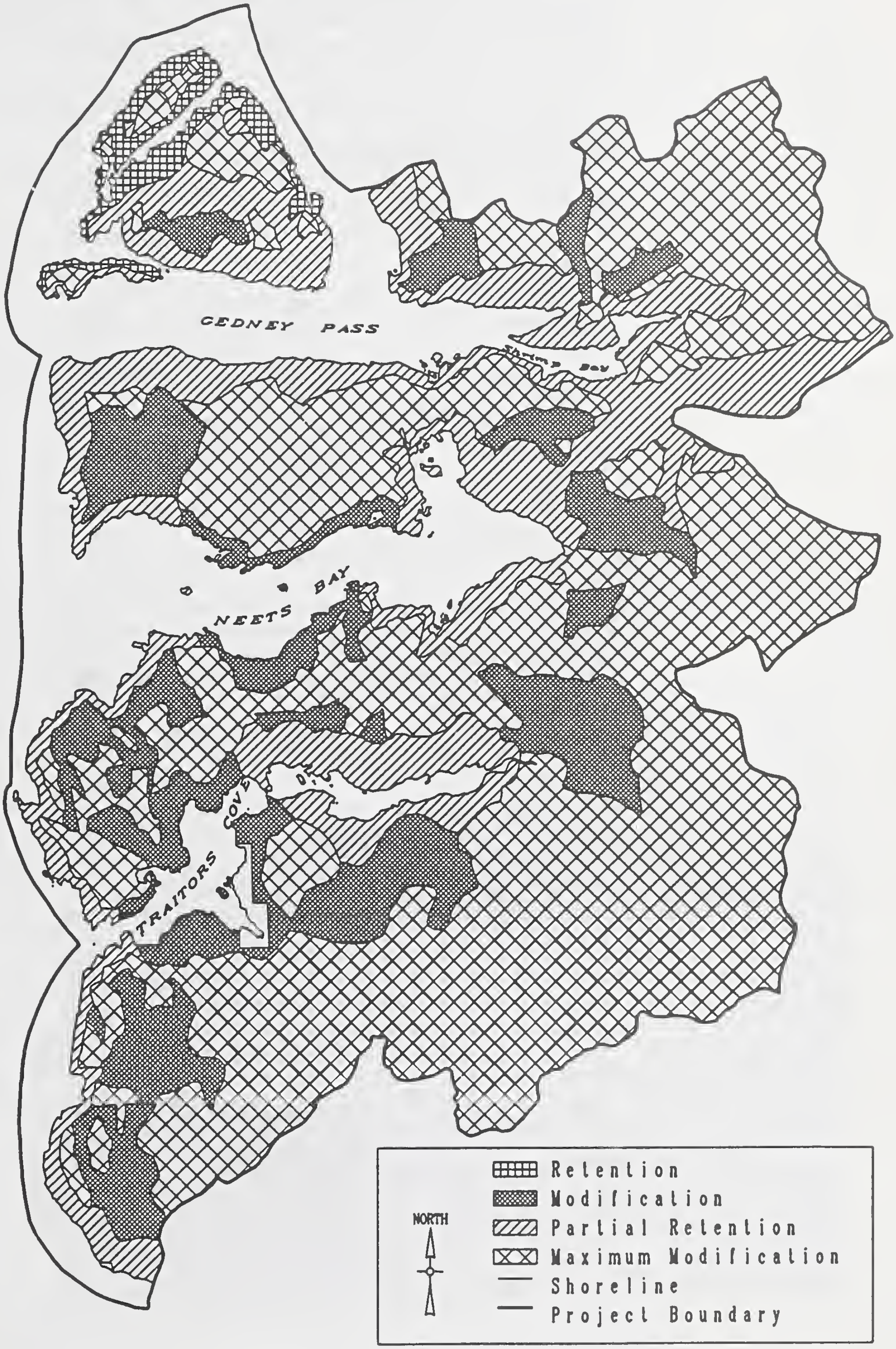


Figure 3-44
North Revilla Project Area Proposed VQO's



The following visual resource management guidelines for timber harvest activities are being applied in the North Revilla EIS. This direction combines the proposed VQO's with Visual Absorption Capacity (VAC) or a landscape's ability to absorb management activities. A low VAC area may reflect steep slopes with little variation in its aspect or tilt to the viewer; a high VAC area normally is found in unseen or slightly sloping terrain. These guidelines are summarized in Table 3-151.

Table 3-151
Visual Resource Guidelines

VQO/VAC Setting	Typical Unit Size (in acres)	Cumulative Visual Disturbance (by percent)	Height-to-Adjacent Mature-Stand (by percent)
Retention/Low	less than 2	8	50
Retention/Med	less than 15	10	50
Retention/High	less than 30	10	30
Partial Retention/Low	less than 10	8	35
Partial Retention/Med	less than 40	15	25
Partial Retention/High	less than 60	20	20
Modification/Low	less than 40	15	25
Modification/Med	less than 60	20	20
Modification/High	less than 100	25	5
Max. Modification/Low	less than 75	50	5
Max. Modification/Med-High	less than 100	50	5

Notes: 1) Cumulative Visual Disturbance (CVD) reflects the maximum allowable percent of a viewshed's seen area to be in a disturbed condition at any one point in time. 2) The above percents, unit sizes, and heights should only be referred to as guidelines; there may be instances where the visual objective can be attained where these numbers are greater or smaller than the guidelines.
SOURCE: Angelus, 1993

A detailed breakdown of past harvest units seen in each viewshed is displayed in Table 3-152. The Orchard Lake viewshed is in a natural condition and is not displayed. The seen acreages are calculated in the "planimetric view", or plan-view. These percents will be lower when calculated from a "perspective views" (acreages cannot be measured, only percent of apparent disturbance).

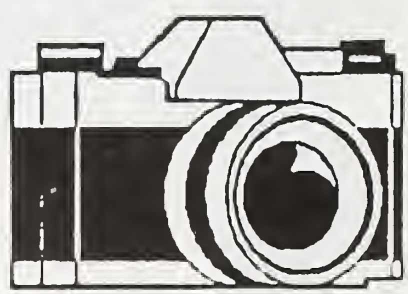


Table 3-152
Past Harvest Units - Existing Visual Disturbance, by Viewshed in Acres

Viewshed Name	Viewshed Seen Acres	Past Seen Harvest	Acres Now Visually Disturbed	CVD Percent Seen	CVD Range Percent
Behm/Indian Pt.	2,036	255	231	11.3	8-15
Behm/Traitors	4,079	890	371	9.1	8-15
Traitors Cove	2,713	725	126	4.6	15-50
Margaret Cove	2,021	509	18	.9	20-50
Inner Traitors	8,078	1,077	788	9.8	8-15
Behm/SW Neets Bay	2,114	476	412	19.5	15-20
Behm/NW Neets Bay	5,256	408	113	2.1	15-20
Inner Neets Bay	3,834	1,148	272	7.1	15-50
Head of Neets Bay	6,036	1,545	85	1.4	8-20
Behm/Gedney Pass	4,018	1,035	224	5.6	8-15
Shrimp Bay	3,812	868	182	4.8	8-15
Klu Bay	2,473	342	88	3.6	8-20
Behm/W. Hassler	1,695	22	0	0	8-15
Behm/N. Hassler	1,316	0	0	0	8-15
So. Hassler Pass	574	0	0	0	8-15
Totals:	50,056	9,300	2,910	5.8 %	

Note: 1. The lower value in the "CVD range" column is for foreground slopes; the higher value is for middleground slopes. 2. Column 4, "CVD percent seen," shows the acreage percentage for second-growth stands that are less than Height-to-Adjacent-Mature-Stand guidelines, with a mature stand height of 120 feet for this EIS.
SOURCE: Angelus, 1993

Individual Viewsheds

The following discussion will cover the visual impacts of the proposed action alternatives within the 16 viewsheds from sample viewpoints. Each viewshed's discussion is preceded by a graphic depiction (perspective plot) of its existing visual condition (EVC). The description will discuss:

* Size in seen acres and type
* Landscape Character
* Proposed Visual Quality Objectives (VQO's)
* TLMP visual disturbance guidelines (CVD)(see Table 3-150)
* Existing Visual Condition (EVC)
* Acres of existing harvest and amount remaining visually disturbed
* Future Visual Condition (FVC) that would result at the end of this harvest period.

Perspective plots also show the location of visual impacts of past timber harvesting. See Figure 3-42 for the location and orientation of the sample viewing platforms or viewpoints.

Perspective views of each action alternative's visual impact on a viewshed can be found in Appendix F.

The discussion order is geographically, by viewshed number, from the southern Behm Canal area (near Naha Bay); north to Traitors Cove, Neets Bay, Gedney Pass; northeast past Hassler Island; finally south to Hassler Pass near Brow Point.

Figure 3-45
Behm Canal at Indian Point Perspective Plot

1. Behm Canal at Indian Point - Indian Point to Francis Cove

This 2,036-acre saltwater viewshed is the first in the Project Area encountered while traveling north from the Clover Pass Scenic Area near Ketchikan, and can be seen from the North Point Higgins area. It is adjacent to the Naha Roadless Area. The landscape character consists of an area one-half to one mile in width with less than 25 percent slopes on interspersed hills and knobs. The landform then rises steeply

to 2,500-foot ridge tops in the middleground. These slopes face southwest to west towards the Naha and Clover Pass areas and Point Francis on the Cleveland Peninsula across Behm Canal. The visual sensitivity of this viewshed makes it a focal point and a subject for much public concern.

Due to the scope and scale of recent harvest (1990) on these highly visible slopes, this area does not meet the proposed VQO of Modification in the middleground. However, the foreground areas do meet the proposed VQO of Partial Retention.

The Cumulative Visual Disturbance (CVD) guidelines range from 8 percent on the foreground slopes to 15 percent on the middleground slopes.

Alternative 1 - No Action

The Existing Visual Condition (EVC) of this viewshed is heavily altered. Of the existing 255 acres of timber harvest, 231 acres (or 11 percent of this viewshed) remain visually disturbed. It, however, will meet the VQO sooner if mitigating actions (through rehabilitation) are taken to change the shape of the largest harvest unit (119 acres) from its geometric appearance to one that resembles a natural opening (one that borrows from naturally established forms and lines). Without these mitigations, the Future Visual Condition (FVC) for this viewshed would remain heavily altered (V) for the next 20–25-years.

Alternatives 2 through 6

There are no units or roads proposed under these alternatives. The FVC will remain the heavily altered.

Table 3-153 summarizes the effects of the alternatives for the Behm Canal at Indian Point viewshed. Figure 3-46 illustrates the existing visual condition of the Behm Canal at Traitors Cove viewshed.

Table 3-153
Effects on Behm Canal at Indian Point Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	2,036					
Existing CVD-Acres	231					
Existing CVD-Percent	11					
CVD range in Percent	8-15					
No. of Units Proposed	0	0	0	0	0	0
No. of Acres	0	0	0	0	0	0
Future CVD-Acres	231	231	231	231	231	231
Future CVD-Percent	11	11	11	11	11	11

SOURCE: Angelus, 1993

Figure 3-46
Behm Canal at Traitors Cove Perspective Plot

2. Behm Canal at Traitors Cove - Francis Cove to Bushy Point

> **Visual Quality Objectives (VQO's)**
>
> **Preservation (P):** permits ecological changes only
>
> **Retention (R):** activities are not evident to the casual Forest visitor
>
> **Partial Retention (PR):** activities may be evident but are visually subordinate to the natural landscape
>
> **Modification (M):** activities may dominate the characteristic landscape; but should resemble natural occurrences when viewed from foreground or middleground
>
> **Maximum Modification (MM):** activities may dominate the landscape, but should appear as a natural occurrence when viewed as background

This 4,079-acre saltwater viewshed continues with the mile-wide shelf in the foreground with moderate slopes to under 1,500-foot elevation. The "viewframe" is bisected by the entrance to Traitors Cove with background views of terrain inside the cove. The most recent harvest (1990) is seen on the south side of the entrance (VCU 740), as shown in the above graphic, and is located on steep sloped knobs facing the viewer. Currently, this area does not meet the proposed VQO of Modification.

The north side of the cove (VCU 738), due to its flat terrain in the foreground mile-wide shelf, is mostly unseen as well as unaltered (not shown in above graphic). The middleground consists of steep slopes rising to nearly 1,500-foot ridgetop and faces southwest towards the viewer. These slopes, harvested in 1958, have regenerated to approximately 50 to 55 feet high.

Currently, this part of the viewshed meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines are 8 percent in the foreground and 15 percent in the middleground.

Alternative 1 - No Action

The EVC of this viewshed ranges from natural condition and slightly altered on the north-side of the Cove entrance to moderately altered south of the entrance. Although 890 acres have been harvested since the late 1950's, 371 seen acres (or 9 percent of this viewshed) remain visually disturbed, mostly on the south side. Left unharvested in this EIS period, the FVC would remain the same except for continuing change in tree height, color and texture.

Alternatives 2 through 6

Harvest units proposed in this viewshed are mostly on the north side of the cove entrance, with Alternative 4 proposing a low two units (120 acres) and Alternative 5 a high six units (211 acres). Additional visual disturbance will range from a low of 11 percent in Alternative 2 to a high of 14 percent in Alternative 5. All units and roads would meet the proposed VQO's. The FVC will be slightly altered in the foreground and moderately altered in the middleground in all alternatives.

Table 3-154 summarizes the alternatives for the Behm Canal at Traitors Cove viewshed.

Table 3-154
Effects on Behm Canal at Traitors Cove Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	4,079					
Existing CVD-Acres	371					
Existing CVD-Percent	9					
CVD range in Percent	8-15					
No. of Units Proposed	0	4	3	2	6	3
No. of Acres	0	80	112	120	211	112
Future CVD-Acres	371	451	483	491	582	483
Future CVD-Percent	9	11	12	12	14	12

SOURCE: Angelus, 1993

Perspective views of each action alternatives visual impact on this viewshed can be found in Appendix F.

The following three viewsheds have unique characters. Once through the narrow Traitors Cove entrance from Behm Canal, one enters Traitors Cove viewshed. Two major canyons split off, one northeasterly through a salt chuck (Inner Traitors Cove); the other southeasterly towards Margaret Lake (Margaret Cove). Traitors Cove and Margaret Cove are part of VCU 738; Inner Traitors Cove is within VCU 739.

Figure 3-47 illustrates the existing visual condition for the Traitors Cove viewshed.

Figure 3-47
Traitors Cove Perspective Plot

3. Traitors Cove Viewshed - From Virgin Bay to Margaret LTF

This 2,713-acre saltwater viewshed is comprised of a 270 degree "viewframe" from a westerly view of Behm Canal to just north of an existing Log Transfer Facility (LTF) on the eastern shore of the cove. This viewshed consists of moderate to steep slopes angled toward the viewer in a bowl effect. Past harvest has occurred along the west shore in the late 1950's; on middleground slopes above the north shore in the mid-1980's; and on the east shore foreground and middleground slopes in the early 1960's.

Currently, this viewshed meets the proposed VQO's of Modification in the foreground and Maximum Modification in the middleground. The CVD guidelines range from 15 percent in the foreground to 50 percent in the middleground.

Alternative 1 - No Action

The EVC of this viewshed ranges from slight to moderately altered. Of the 725 seen acres harvested since 1958, 126 acres (or five percent of the viewshed) remain visually disturbed. The FVC would remain the same except for a change in tree height, color and texture.

Alternatives 2 through 6

Harvest units proposed in alternatives 2, 3, 5, and 6 are located above the north and eastern shores near the salt chuck. Alternative 4 proposes 5 units (or 261 seen acres) only on the east and southeastern slopes above the Margaret Cove LTF; these are leave islands from harvesting in the early 1960's.

As proposed, all units would meet the VQO's. For Alternatives 2,3,4, and 6, the FVC will range from moderately to heavily altered. For Alternative 5, it will remain from slightly to moderately altered.

Table 3-155 summarizes the effects of the alternatives on the Traitors Cove viewshed. Figure 3-48 illustrates the EVC of the Margaret Cove viewshed.

Table 3-155
Effects on Traitors Cove Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	2,713					
Existing CVD-Acres	126					
Existing CVD-Percent	5					
CVD range in Percent	15-50					
No. of Units Proposed	0	10	9	5	6	9
No. of Acres	0	431	482	261	255	466
Future CVD-Acres	126	557	608	387	381	592
Future CVD-Percent:	5	21	22	10	14	22

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-48
Margaret Cove Perspective Plot

4. Margaret Cove Viewshed

Located southeast of Traitors Cove, this 2,021-acre salt water viewshed consists of a deeply indented canyon with extensive harvesting in evidence along a wide bottomed valley straddling Margaret Creek and Lake. The view from saltwater is located near the existing LTF on the eastern shore. Due to the wide flat-bottom nature of this viewshed, over 66 percent is unseen. Primarily, the immediate foreground (private land) and the far distant middleground slopes from the 500 to 1,000-foot elevations are the only areas visible.

This viewshed currently meets the proposed VQO's of Modification in the foreground and Maximum Modification in the middleground. The CVD guidelines are 20 percent in the foreground and 50 percent in the middleground.

Alternative 1 - No Action

The EVC of this saltwater viewshed is slightly altered. Of 509 seen acres harvested since 1957, only 18 acres (or one percent of the viewshed) remain visually disturbed. The FVC would remain the same, except for changes in tree height, color and texture.

Alternatives 2 through 6

All five action alternatives propose entries in this viewshed, with alternatives 5 and 6 increasing the visual disturbance by 9 percent each, while alternatives 2, 3 and 4 would increase the disturbance by 21, 12, and 8 percent respectively. The apparent visual impact to the observer would be greatest from alternatives 3 and 6.

As proposed, all units and roads would meet the proposed VQO's. The FVC for alternatives 3 and 6 would be heavily altered; for alternative 4, moderately altered; while alternatives 2 and 5 would remain slightly altered.

Table 3-156 summarizes the effects of the alternatives on the Margaret Cove viewshed. Figure 3-49 illustrates the EVC of the Inner Traitors Cove viewshed.

Table 3-156
Effects on Margaret Cove Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	2,021					
Existing CVD-Acres	18					
Existing CVD-Percent	1					
CVD range in Percent	20-50					
No. of Units Proposed	0	10	6	4	7	5
No. of Acres	0	416	243	153	188	174
Future CVD-Acres	18	434	261	171	206	192
Future CVD-Percent	1	22	13	9	10	10

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-49
Inner Traitors Cove Perspective Plot

5. Inner Traitors Cove Viewshed - At the head of Traitors Cove

This 8,078-acre saltwater viewshed has some unique features in the context of the Project Area. Public scoping revealed a concern for the scenic quality in this area. It begins at a salt chuck, twists and turns for four miles, averaging one-quarter mile in width, and features the earliest timber harvest entry on the Project Area (1942). The landscape character can best be described as intimate, owing to the vertical nature of the canyon walls, heavy old-growth forest close to the viewer, and the absence of any long views.

This viewshed, the largest in the Project, is primarily located on either side of the cove up to 1,000 to 1,500-foot elevations. Middleground views are found at the head of the cove above Traitors Creek. In addition to the 1942 entry, this viewshed has seen activity in all decades for a total of 1,077 seen acres. Most of the visible harvest occurred along the shorelines.

Currently, this viewshed meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines range from 8 percent for foreground slopes to 20 percent for middleground slopes.

Alternative 1 - No Action

The EVC of this viewshed ranges from slightly altered on the north, northeast, and southwest shore; moderately altered on the northwest and southeast shore; to a natural condition on the upper middleground slopes at the head of the cove. Of the 1,077 seen acres harvested, 788 acres (or 10 percent of the viewshed) remain visually disturbed. The FVC would remain the same, except for a change in tree height, color and texture.

Alternatives 2 through 6

Within this unique viewshed, Alternative 2 proposes the most visual disturbance (7 percent; 19 units or 586 acres). Alternative 4 offers the least additional visual disturbance (4 percent; 6 units or 317 acres), but the largest average unit size - 53 acres. Although Alternative 5 proposes a four percent increase (15 units or 347 acres), it has the smallest average unit size - 23 acres.

The apparent visual impact to the observer from timber harvest would be greatest from Alternative 6 due to a grouping of Units 9054, 9071 and 9072 at the head of the cove above and adjacent to late-1970's harvest. Alternative 2 offers the most visual impact from a combination of timber harvest and the Margaret Bay-Traitors Creek road connection. This road would introduce an unnatural horizontal line on the south shore with the additional impact of exposed white rock talus slopes above and below its alignment. The IDT proposes mitigating its impact to meet the Partial Retention VQO by end-haul, careful siting to natural benches, extra narrow right-of-way clearing, and through the use of natural-colored paint emulisfiers on exposed rock.

With these mitigations in place, all proposed units and roads would meet the proposed VQO's and the FVC for these action alternatives would be moderately altered.

Table 3-157 summarizes the effects of the alternatives on the Inner Traitors Cove viewshed.

Table 3-157
Effects on Inner Traitors Cove Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	8,078					
Existing CVD-Acres	788					
Existing CVD-Percent	10					
CVD range in Percent	8-20					
No. of Units Proposed	0	19	13	6	15	12
No. of Acres	0	586	507	317	347	538
Future CVD-Acres	788	1,374	1,295	1,105	1,135	1,326
Future CVD-Percent	10	17	16	14	14	16

SOURCE: Angelus, 1993

Perspective views of each action alternatives' visual impact on this viewshed can be found in Appendix F.

The following two viewsheds in VCU 736, Behm Canal at SW Neets Bay and Behm Canal at NW Neets Bay, are the most sensitive after Indian Point and North Hassler Island. This is due to the three-mile width of Neets Bay, the long duration of view by boaters crossing the Bay, the high degree of visibility of its terrain (moderate slope angling evenly away from viewer), and the even texture and color of vegetation.

Figure 3-50 illustrates the EVC of SW Neets Bay viewshed.

Figure 3-50
Behm Canal at SW Neets Bay Perspective Plot

6. Behm Canal at Southwest Neets Bay - Bushy Pt. to Bug Island

This 2,114-acre saltwater viewshed is located in VCU 736. All harvest in this area has occurred since 1985 on the middleground slopes and draws much attention due to the sharp differences in color, edge and line contrasts, and scale of harvest, resulting in heavily altered visual impacts.

Due to this recent harvest, this area currently does not meet the proposed Modification VQO for middleground views. However, it meets the proposed VQO of Partial Retention for foreground views. The CVD guidelines are 15 percent for foreground slopes and 20 percent for middleground slopes.

Alternative 1 - No Action

The EVC of this viewshed is heavily altered. Of the 476 seen acres harvested since 1960, 412 acres (or 20 percent of the viewshed) were harvested as recent as 1986 and remain visually disturbed. The FVC would remain the same, except for continuing change in tree height, color and texture.

Alternatives 2,3,5 and 6

Based on perspective plot analysis (see Appendix F), all proposed harvest units and roads do not add appreciably to visual impacts due to their oblique or tilted aspect to the viewer. The amount of additional visual disturbance ranges from one percent in Alternative 2 to three percent in Alternative 3. In alternatives 3 and 6, a grouping of three units, 6021 through 6023, would be located immediately adjacent to the beach fringe buffer and would mostly be screened from view. Other units proposed are located on ridge tops in the middleground.

All units would meet the proposed VQO's. The FVC would remain heavily altered in the action alternatives, 2, 3, 5, and 6..

Alternative 4

There are no units or roads proposed under this alternative. The FVC would remain heavily altered.

Table 3-158 summarizes the effects of the alternatives for the Behm Canal at SW Neets Bay. Figure 3-51 illustrates the EVC of the Behm Canal at NW Neets Bay viewshed.

Table 3-158
Effects on Behm Canal at SW Neets Bay Viewshed

	Summary of the Alternative					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	2,114					
Existing CVD-Acres	412					
Existing CVD-Percent	20					
CVD range in Percent	15-20					
No. of Units Proposed	0	4	5	0	1	6
No. of Acres	0	37	78	0	46	86
Future CVD-Acres	412	449	490	412	458	498
Future CVD-Percent	20	21	23	20	22	24

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-51
Behm Canal at NW Neets Bay Perspective Plot

7. Behm Canal at NW Neets Bay - Brow Point to Bug Island

This 5,256-acre saltwater viewshed features the prominent Chin Point, a local landmark. After a boater rounds the headland of SW Neets Bay, the view of Chin Point and the ridge tops at the 2,000- to 2,500-foot elevations, remain in the "viewframe" for an extended time. Harvesting has not occurred in this area since the mid-1970's.

Currently, this viewshed meets the proposed VQO's as noted below. The western half of this salt water viewshed is considered more sensitive visually to Behm Canal observers. The proposed VQO's in this area are Partial Retention in the foreground and Modification in the middleground. The eastern half has proposed VQO's of Modification in the foreground, and Maximum Modification in the middleground. The CVD guideline ranges from 15 to 20 percent in the western half, and 20 to 50 percent in the eastern half.

Alternative 1 - No Action

The EVC of this viewshed appears as slightly altered in both foreground and middleground. Of 408 seen acres harvested since 1960, only 113 (or two percent of the viewshed) remain visually disturbed. Left unchanged, the FVC would improve to a natural appearing condition.

Alternatives 2 through 6

Between 9 and 11 units (269 to 570 seen acres) are proposed in each of the action alternatives for this viewshed. Visual disturbance increases would range from 5 to 11 percent over current seen alterations. Alternative 5 proposes the smallest average unit size (27 acres), while Alternative 3 has the largest average unit size (56 acres). Visual impacts will be lessened in alternatives 2, 4, and 6 through the use of shelterwood prescriptions on two visibily prominent units, 6003 and 6007.

Therefore, all units proposed would meet the proposed VQO's and would result in a FVC of moderately altered for all action alternatives.

Table 3-159 summarizes the effects of the alternatives on the Behm Canal at NW Neets Bay viewshed. Figure 3-52 illustrates the EVC of the Inner Neets Bay viewshed.

Table 3-159
Effects on Behm Canal at NW Neets Bay Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	5,256					
Existing CVD-Acres	113					
Existing CVD-Percent	2					
CVD range in Percent	15-50					
No. of Units Proposed	0	11	9	9	10	10
No. of Acres	0	570	508	474	269	533
Future CVD-Acres	113	683	621	587	382	646
Future CVD-Percent	2	13	12	11	7	12

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-52
Inner Neets Bay Perspective Plot

8. Inner Neets Bay - Bug Island to Easy and Vox Points

This 3,834-acre saltwater viewshed is located between Behm Canal and the head of Neets Bay along both north and south shores of Neets Bay. Its terrain features are similiar to both NW and SW Neets Bay viewsheds as discussed above. Although harvest has occurred in this area since 1955, most has regenerated to 48 to 58 feet.

Currently, this viewshed meets the proposed VQO's of Modification in the foreground and Maximum Modification in the middleground. The CVD guidelines are 15 percent for foreground slopes and 50 percent for middleground slopes.

Alternative 1 - No Action

The EVC of this viewshed ranges from slightly altered on the north side of the bay to moderately altered on the south side. Of the 1,148 seen acres harvested since 1955, only 142 acres (or four percent of the viewshed) remain visually disturbed. The FVC would remain the same except for the continuing change in tree height, color and texture.

Alternatives 2 through 6

Alternative 2 offers the smallest number of units (2), but the largest average unit size (99 acres) within this viewshed. Alternative 5 proposes harvesting the most units (10), but with the smallest average unit size (28 acres). The visual disturbance would increase the least (five percent) in alternatives 2 and 3, while alternatives 4, 5, and 6 would add the most (seven percent).

All units and roads proposed would meet the proposed VQO's and the FVC would be moderately altered for all alternatives.

Table 3-160 summarizes the effects of the alternatives on the Inner Neets Bay viewshed. Figure 3-53 illustrates the EVC of the Head of Neets Bay viewshed.

Table 3-160
Effects on Inner Neets Bay Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	3,834					
Existing CVD-Acres	272					
Existing CVD-Percent	7					
CVD range in Percent	15-50					
No. of Units Proposed	0	4	2	4	10	4
No. of Acres	0	186	198	252	279	256
Future CVD-Acres	272	458	470	524	551	528
Future CVD-Percent	7	12	12	14	14	14

SOURCE: Angelus, 1993

Perspective views of each action alternatives' visual impact on this viewshed can be found in Appendix F.

Figure 3-53
Head of Neets Bay Perspective Plot

9. **Head of Neets Bay - Easy Point to SSRAA Fish Hatchery**

This 6,036-acre saltwater viewshed is located within VCU 737. An anchorage and private fish hatchery are located at the head of this bay resulting in moderate boating activity.

Currently, this viewshed meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines ranges from 8 percent for foreground views to 50 percent for middleground views.

Alternative 1 - No Action

The EVC of this viewshed ranges from slightly altered to moderately altered. Of the 1,545 seen acres harvested since 1953, only 85 acres (or one percent of the viewshed) remain visually disturbed. The FVC and landscape mosaic would remain the same except for continuing changes in tree height, color and texture.

Alternatives 2 through 6

Alternatives 3 and 6 each offer the smallest number of units (11) within this viewshed. Conversely, alternative 5 proposes the most units (29) but with the least average unit size (22 acres). Alternatives 3 and 6 would increase the visual disturbance the least (six percent) by not entering the steep-sloped northeast to southeast quadrants of the viewshed. Alternative 2 proposes units on these same steep slopes with one unit in particular, Unit 7038, in the foreground. This unit is proposed to be harvested with a shelterwood prescription. Both proposals of alternatives 4 and 5 would increase the visual impact the most (11 percent).

As designed, all units would meet the proposed VQO's and the FVC would be moderately altered in all alternatives.

Table 3-161 summarizes the effects of the alternatives on the Head of Neets Bay viewshed. Figure 3-54 illustrates the EVC of the Behm Canal at Gedney Pass viewshed.

Table 3-161
Effects on Head of Neets Bay Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	6,036					
Existing CVD-Acres	85					
Existing CVD-Percent	1					
CVD range in Percent	8-50					
No. of Units Proposed	0	21	11	19	29	11
No. of Acres	0	578	306	647	639	344
Future CVD-Acres	85	663	391	732	724	429
Future CVD-Percent	1	11	7	12	12	7

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-54
Behm Canal at Gedney Pass Perspective Plot

10. Behm Canal at Gedney Pass - Brow Point to Dress Point

This 4,018-acre saltwater viewshed comprises the south shore of Gedney Pass and the south shore of Hassler Island (southern half of VCU 735). Harvest occurred along the shorelines in late 1950's to early 1960's, and is approximately 50 feet in height. The slopes above these harvested areas rise steeply and evenly without much variation, except for rock outcrops, to 2,000 to 2,500-foot ridge tops.

This viewshed currently meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines range from 8 percent on the foreground slopes to 15 percent on the middleground slopes.

Alternative 1 - No Action

The EVC of south Hassler Island appears as moderately altered, and the south shore of Gedney Pass appears as slightly altered. Of the 1,035 acres of original harvest, only 224 acres (or six percent of the viewshed) remain visually disturbed. The FVC and landscape mosaic would remain the same except for continuing changes in tree height, color and texture.

Alternatives 2, 3, 4 and 6

Alternatives 2, 4, and 6 would harvest units on both shores, with alternative 4 providing the most units (6) and most additional visual disturbance (eight percent). Alternative 2 proposes the largest average unit size (58 acres). Alternative 3 would harvest the least number of units (2), and on Hassler Island only, while visually impacting this viewshed the least (two percent); its average unit size is the smallest at 42 acres.

All units would meet the proposed VQO's. The FVC would be moderately altered in alternatives 2, 4, and 6, while it would range from slightly altered to moderately altered in Alternative 3.

Alternative 5

There are no units or roads proposed under this alternative. The FVC would remain from slightly altered to moderately altered.

Table 3-162 summarizes the effects of the alternatives on the Behm Canal at Gedney Pass viewshed. Figure 3-55 illustrates the EVC of the Shrimp Bay viewshed.

Table 3-162
Effects on Behm Canal at Gedney Pass Viewshed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	4,018					
Existing CVD-Acres	224					
Existing CVD-Percent	6					
CVD range in Percent	8-15					
No. of Units Proposed	0	4	2	6	0	5
No. of Acres	0	233	83	339	0	213
Future CVD-Acres	224	457	307	563	224	437
Future CVD-Percent	6	11	8	14	6	11

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-55
Shrimp Bay Perspective Plot

11. Shrimp Bay - Dress Point to Orchard Lake Falls

This 3,812-acre saltwater viewshed comprises the shorelines near Dress Point and the south shores of Shrimp Bay, including a heavily altered peninsula. Harvested in the late 1950's, regeneration has been slowed from the effects of poor soil characteristics and a wildfire. Extremely steep slopes are found north of Shrimp Bay while south to southeast views are of 400 to 600-foot cliffs rising to a flattened shelf, then rising steeply to 2600-foot ridgetops in the middleground.

Currently, this viewshed meets the proposed VQO's of Partial Retention in foreground and Modification in middleground. The CVD guidelines are 8 percent for foreground slopes and 15 percent for middleground slopes.

Alternative 1 - No Action

The EVC is from natural appearing on the south shore's middleground slopes to moderately altered along the north shorelines. Of the 868 seen acres harvested, only 182 acres (or five percent of the viewshed) remain visually disturbed. The FVC and landscape mosaic will remain the same except for continuing changes in tree height, color and texture.

Alternatives 2 through 6

Alternative 3 offers the smallest number of units (2) and average unit size (six acres). This small amount of harvest does not add appreciably to the existing visual disturbance level. Alternative 4 proposes the largest number of units (7), the largest average unit size (45 acres), and the most additional visual disturbance (eight percent). In the close foreground and on the steep slopes of the northern shore, Unit 3002 is proposed for a shelterwood prescription and would, therefore, lessen some of these visual effects. Alternatives 3, 5, and 6 propose no units on the northern shore.

The units as proposed in all alternatives would meet the proposed VQO's. The FVC would range from a natural appearing condition to a moderately altered appearance for Alternatives 3, 5, and 6. The FVC would be moderately altered for alternatives 2 and 4.

Table 3-163 summarizes the effects of the alternatives on the Shrimp Bay viewshed. Figure 3-56 illustrates the EVC of the Klu Bay viewshed.

Table 3-163
Effects on Shrimp Bay Viewshed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	3,812					
Existing CVD-Acres	182					
Existing CVD-Percent	5					
CVD range in Percent	8-15					
No. of Units Proposed	0	6	2	7	4	4
No. of Acres	0	206	12	312	67	157
Future CVD-Acres	182	388	194	494	249	339
Future CVD-Percent	5	10	5	13	7	9

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-56
Klu Bay Perspective Plot

12. Klu Bay Viewshed - Off of Shrimp Bay

This 2,473-acre saltwater viewshed is located just north of the Orchard Lake waterfalls at the head of Shrimp Bay. Visually, it is affected by the burned peninsula mentioned above as well as 35-year-old harvest areas in the immediate foreground.

This viewshed has similar strong visual impacts in the immediate foreground from the old Klu Bay LTF site as were found in the Shrimp Bay viewshed.

Currently, this viewshed meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines are 8 percent on the foreground slopes and 20 percent on the middleground slopes.

Alternative 1 - No Action

The EVC ranges from Natural Condition on the northwestern and northern slopes to Moderately Altered on the eastern and southeastern slopes. Of the 342 seen acres harvested since 1957, only 88 acres (or four percent of the viewshed) remain visually disturbed. Left unchanged, the FVC and landscape mosaic would remain the same except for continuing change in tree height, color and textures.

Alternatives 2 through 6

Of the action alternatives, Alternative 3 offers the least harvest units (4) and the least amount of additional visual disturbance (seven percent). Conversely, Alternative 5 proposes the most units (8), but with the smallest average unit size (27 acres). Alternative 2's proposal would visually disturb the most acreage (12 percent).

However, as proposed, all units would meet the proposed VQO's and the FVC for alternatives 2, 3, 4 and 6 would be moderately altered. The future Visual Condition for Alternative 5 would range from slightly altered to moderately altered.

Table 3-164 summarizes the effects of the alternatives on the Klu Bay viewshed. Figure 3-57 illustrates the EVC of the Orchard Lake viewshed.

Table 3-164
Effects on Klu Bay Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	2,473					
Existing CVD-Acres	88					
Existing CVD-Percent	4					
CVD range in Percent	8-20					
No. of Units Proposed	0	7	4	6	8	7
No. of Acres	0	306	172	253	217	290
Future CVD-Acres	88	394	260	341	305	378
Future CVD-Percent	4	16	11	14	12	15

SOURCE: Angelus, 1993

Perspective views of each action alternative's visual impact on this viewshed can be found in Appendix F.

Figure 3-57
Orchard Lake Perspective Plot

13. Orchard Lake - Upstream from waterfalls at Shrimp Bay

This 3,464-acre viewshed is the only freshwater viewshed considered. During the public scoping comment period in the fall of 1991, residents and visitors alike commented on its uniqueness. There are two Forest Service cabins on the lake: one near the waterfalls outlet (Plenty Cutthroat) and the other at the head of the lake (Orchard Lake). This latter cabin is outside the Project Area. This viewshed's visual appearance is in a natural condition with unaltered far-middleground views of mountaintops of the Shrimp Bay viewshed to the west and Klu Bay viewshed to the north and northeast.

Although timber harvest is precluded in this viewshed, any future recreational facility or management activities are proposed to meet the Partial Retention VQO in both the foreground and middleground.

There is no alternative summary table supplied for this viewshed.

The next three viewsheds are perhaps the most sensitive in the Project Area. Hassler Island represents a transition zone from the Misty Fiords National Monument and primitive viewsheds near Yes Bay and Bell Island to the more developed West Behm Canal area. Clients of two private resorts, charter boat operations, and tour ships frequently are in this area. Public comments from the Draft EIS voiced concern about too much visual impact from timber operations on the Island. Perspective views of each action alternative immediately follows each viewsheds' discussion. These views or computer drawings can also be found in Appendix F.

Figure 3-58 illustrates the EVC of the Behm Canal at West Hassler Island viewshed.

Figure 3-58
Behm Canal at West Hassler Perspective Plot

14. Behm Canal at West Hassler - Gedney Island to Black Island

This 1,695-acre salt water viewshed is viewed from the entrance to Yes Bay across Behm Canal west of Hassler Island. Three islands are in this viewframe: Gedney Island on the right, Hassler Island in the middle, and Black Island on the left. Hassler Island's visually sensitive (low VAC) slopes as seen from this vantage point are primarily those above Blind Pass (between Black and Hassler Islands) and the western face of of the island.

No harvest activities are proposed on either Black or Gedney Islands in this EIS.

Currently, this viewshed meets the proposed VQO's of Retention in the foreground and Partial Retention in the middleground. The CVD guidelines are 8 percent on the foreground slopes and 15 percent on the middleground slopes.

Alternative 1 - No Action

The EVC of this viewshed ranges from natural condition to natural appearing. Of the 22 acres harvested in the early 1950's along the shoreline, none remain visually disturbed. Undisturbed, the FVC would remain the same except for continuing change in tree height, color, and textures.

Alternatives 2 through 6

Alternative 5 would harvest the lowest number of units (2), has the smallest average unit size (20 acres), and would visually disturb the least amount (two percent) of this viewshed. Alternatives 2, 3, 4, and 6 each would visually impact it the most with five units each, ranging from 7 to 10 percent visual disturbance. Alternative 6 proposes the largest average unit size at 34 acres. All units and proposed roads without exposed rockpits would meet the proposed VQO's and the FVC for all alternatives be slightly altered.

Table 3-165 summarizes the effects of the alternatives on the Behm Canal at West Hassler Island viewshed. Figure 3-59 displays graphically the effect of the alternatives. Figure 3-60 illustrates the EVC of the Behm Canal at North Hassler Island viewshed.

Table 3-165
Behm Canal at West Hassler Island Viewshed

	Summary of the Alternatives					
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	1,695					
Existing CVD-Acres	0					
Existing CVD-Percent	0					
CVD range in Percent	8-15					
No. of Units Proposed	0	5	5	5	2	5
No. of Acres	0	121	159	120	39	172
Future CVD-Acres	0	121	159	120	39	172
Future CVD-Percent	0	7	9	7	2	10

SOURCE: Angelus, 1993

Figure 3-59
Behm/West Hassler Alternative Views

Alternative 2

Alternative 3

Alternative 4

Alternative 5

Alternative 6

Figure 3-60
Behm Canal at North Hassler Perspective Plot

15. Behm Canal at North Hassler - Black Island to Curlew Point

This 1,316-acre salt water viewshed is viewed from northwest Behm Canal near Snipe Point on Bell Island. From this viewpoint, all of the northern portions of Hassler Island and Black Island can be seen between Hassler Pass and northwest Behm Canal.

Currently, this viewshed meets the proposed VQO's of Retention in the foreground and Partial Retention in the middleground. The CVD guidelines are 8 percent in the foreground and 15 percent in the middleground.

Alternative 1 - No Action

The EVC of this viewshed is in a natural condition. Left as is, the FVC would remain the same except for continuing change in tree height, color, and textures.

Alternatives 2 through 6

All units meet the proposed VQO's.

Table 3-166 summarizes the effects of the alternatives on the Behm Canal at North Hassler Island viewshed. Figure 3-61 displays graphically the effects of the alternatives. Figure 3-62 illustrates the EVC of the South Hassler Pass viewshed.

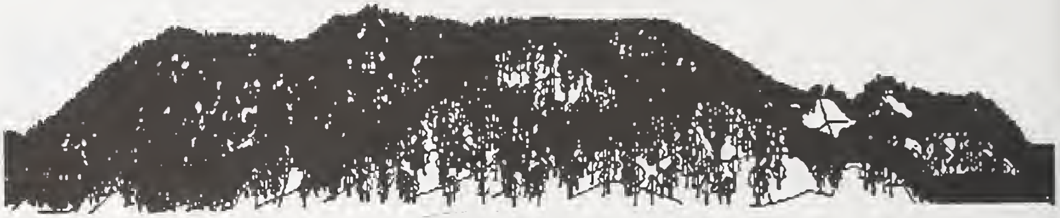
Table 3-166
Effects on Behm Canal at North Hassler Island Viewshed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	1,316					
Existing CVD-Acres	0					
Existing CVD-Percent	0					
CVD range in Percent	8-15					
No. of Units Proposed	0	9	5	11	8	6
No. of Acres	0	172	138	227	136	162
Future CVD-Acres	0	172	138	227	136	162
Future CVD-Percent	0	13	11	17	10	12

SOURCE: Angelus, 1993

Figure 3-61
Behm/North Hassler Alternative Views

Alternative 2



Alternative 3

Alternative 4

Alternative 5

Alternative 6

Figure 3-62
South Hassler Pass Perspective Plot

16. South Hassler Pass - Fin Point to the Hassler Island LTF

This 574-acre salt water viewshed, the smallest in this Project Area, is viewed from the opposite shore of Hassler Pass just north of Gedney Pass near Dress Point. Hassler Pass is very similar in visual character to Inner Traitors Cove viewshed. This is due to its narrow (less than a mile wide) waterway surrounded by very steep slopes rising from water line to nearly 2,000-foot on the west and 3,000-foot on the east. The above graphic depicts a western view of Hassler Island.

Currently, this viewshed meets the proposed VQO's of Partial Retention in the foreground and Modification in the middleground. The CVD guidelines range from 8 percent in the foreground to 15 percent in the middleground.

Alternative 1 - No Action

The EVC of this viewshed is natural appearing. The FVC will remain the same except for continuous change in tree height, color, and texture.

Alternatives 2 through 6

All units meet the proposed VQO's.

Table 3-167 summarizes the effects of the alternatives on the South Hassler Pass viewshed. Figure 3-63 displays graphically the effects of the alternatives.

Table 3-167
Effects on South Hassler Pass Viewshed

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6
Viewshed Acres	574					
Existing CVD-Acres	0					
Existing CVD-Percent	0					
CVD range in Percent	8-15					
No. of Units Proposed	0	5	4	4	3	4
No. of Acres	0	83	65	71	32	65
Future CVD-Acres	0	83	65	71	32	65
Future CVD-Percent	0	15	11	12	6	11

SOURCE: Angelus, 1993

Figure 3-63
South Hassler Pass Alternative Views

Summary of the Direct Effects

Any action alternative would meet the proposed VQO's and the Forest Plan Standards and Guidelines proposed in the TLMP Draft Revision (1991a).

Behm Canal Viewsheds:

The seven Behm Canal viewsheds, totaling 20,514 seen acres, account for 41 percent of the visible Project Area suitable for harvest. Of the 3,086 seen acres harvested since 1954, 1,351 acres (or 44 percent) remain visually disturbed. These disturbed acres account for 7 percent of the Behm Canal viewsheds. Alternative 5 proposes the fewest acres (701) and units (27). Alternative 4 proposes the most acres (1,280) and Alternative 2, the most units (37). Additional visual disturbance would increase the most (or 6 percent) in Alternatives 2, 4 and 6; and the least in Alternative 5 (or 3 percent).

Interior Bay Viewsheds:

The eight Interior Bay viewsheds, totaling 29,542 seen acres, account for 59 percent of the visible Project Area suitable for harvest. Of the 6,214 seen acres harvested since 1942, 1,559 acres (or 31 percent) remain visually disturbed. These disturbed acres account for 5 percent of the Interior Bay viewsheds. Alternative 3 proposes the fewest acres (1,985) and units (51). Alternative 2 proposes the most acres (2,792) and Alternative 5 the most units (92). Additional visual disturbance would increase the most in Alternative 2 (nine percent), and the least in Alternative 3 (seven percent).

Project Area Viewsheds:

Excluding the Orchard Lake viewshed, the North Revilla Project Area totals 50,056 seen acres. Of the 9,300 seen acres of harvest since 1942, 2,910 acres (or 31 percent) remain visually disturbed. These disturbed acres account for 6 percent of the Project Area viewsheds. Alternatives 3 proposes harvesting the least number of units (80), and alternatives 2 and 5 would harvest the most units (119). Alternative 5 would visually disturb the fewest acres (2,735) and Alternative 2, the most acres (4,005). Additional visual disturbance would increase the most in Alternative 2 (eight percent), and the least in Alternative 5 (five percent).

Cumulative Effects

Alternative 2, which harvests the maximum amount of timber allowed under Forest Plan standards and guidelines, was used to project the level of harvest through year 2004. It is assumed that reduced levels of harvest, as part of another alternative, will be harvested in a future entry.

Assuming a continuation of the present harvest level (3–5 entries per 100 years) and implementation of resource constraints, in accordance with the Forest Plan through the year 2140, timber harvest would continue to occur in the North Revilla Project Area. Over time, as further entries occur beyond year 2004, the distribution of additional harvest units would add to visual diversity, thereby increasing the capacity of a viewsheds' ability to absorb future alterations. During this time, the forest would become a mosaic of varying sizes, shapes, heights, and textures reflecting those alterations. This mosaic would, therefore, achieve the desired future condition of the Forest Plan.

Log Transfer Facilities (LTFs) and Logging Camps

The large size, linear bold shape, and shoreline location of LTFs generally dominates the landscape when viewed within a foreground distance (less than 1/2 mile). When seen as background (more than 3-5 miles), however, they are subordinate to the characteristic landscape. Clearings for sort yards and logging camps also add to the visual impacts associated with LTFs. However, their location is usually on level or gently sloping sites. Therefore, they have a higher visual absorption capability to help absorb much of their visual contrasts when viewed from salt water.

There are not any new sort yards or land-based camps considered in any of the alternatives in this Project Area. Floating logging camps are being considered for this project with upland development consisting of maintenance shops and fuel storage tanks. These camps normally present a visually obtrusive element in the characteristic landscape due to an introduction of hard, geometric shapes and unnatural colors at or near water line. These impacts can be mitigated through the use of natural paint colors. However, visual impacts from these camps will be short-term.

Ramp-type LTF's present less of a visual impact than bulkhead-type facilities. The low profile of a ramp facility combined with natural materials found at or near the site helps lessen any texture and color contrasts. The bold form of the bulkhead prevents it from blending into the surrounding landscape. The type of material and color of the bulkhead creates strong contrasts that can sometimes be seen in the background distance zone (more than 3–5 miles).

The following LTF's are proposed under one or more of the action alternatives:

Chin Point LTF
This ramp-type LTF would be located on the north shore of Neets Bay where it would be seen as middleground from Behm Canal and the center of Neets Bay, both priority marine travel routes. This site would only meet the proposed VQO of Partial Retention if a beach fringe of trees is left to help mitigate the visibility of the upland facilities. This LTF location would be used in all action alternatives.

Fire Cove LTF
This bulkhead-type LTF and float camp would be a reconstruction of an old LTF on the southeastern shore of Neets Bay. It would be seen as middleground from a priority marine travel route in the center of the Bay. Neither the LTF nor the float camp would meet the proposed VQO of Partial Retention. This LTF location would be used in all the action alternatives.

Hassler Island LTF
This bulkhead-type LTF would be a reconstruction of an old LTF on the eastern shore of Hassler Pass. It would not meet the proposed VQO of Partial Retention for a foreground view in south Hassler Pass. This LTF location would be used in all the action alternatives.

Klu Bay LTF
This bulkhead-type LTF would be a reconstruction of an old LTF site on the southeastern shore of Klu Bay. It and a possible float camp would be seen as foreground from the center of this small, enclosed bay and would not meet the proposed VQO of Partial Retention. This LTF location would be used in all the action alternatives.

Margaret Bay LTF

This bulkhead-type LTF is just north of Margaret Creek on the eastern shore of Traitors Cove. It is seen as middleground from the center of Traitors Cove, a marine travel route, and meets the proposed VQO of Modification. This LTF location would be used in all the action alternatives.

S.W. Neets Bay LTF

This bulkhead-type LTF would be a reconstruction of an old LTF located in a cove on the southwest shore of Neets Bay. This site would be seen as middleground from Behm Canal and from the center of Neets Bay and would not meet the proposed VQO of Partial Retention. If a float camp were located here, it would not meet the proposed VQO while in place. This LTF location would be used in action Alternatives 2, 3, 4, and 6.

Shrimp Bay LTF

This bulkhead-type LTF would be a reconstruction of an old LTF located in a small cove on the south shore of Shrimp Bay. It would be seen obliquely (from the side) as middleground from Brow Point and the anchorage near the Orchard Creek waterfalls and would meet the proposed VQO of Partial Retention. If a float camp were located here and within full sight of the anchorage, it would not meet the proposed VQO. This LTF location would be used in all the action alternatives.

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LAND ADJUSTMENTS, USES, AND PERMITS

Key Terms

Alaska Native Claims Settlement Act (ANCSA) - provides for the settlement of certain land claims of Alaska natives
Encumbrance - a claim, lien, charge, or liability attached to and binding real property
Native Selection - application by Native corporations to the USDI Bureau of Land Management for conveyance of a portion of lands withdrawn under ANCSA in fulfillment of Native entitlements established under ANCSA
Special Use Permits - permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land
State Selection - application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000-acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act

Affected Environment

Land Status

Prior to 1971, the Tongass National Forest, Ketchikan Administrative Area land ownership pattern had not changed significantly, with only minor changes taking place as National Forest System lands were transferred to private home sites, canneries, and townsites. Beginning in the early 1970's land ownership changes were made as a result of legislation, including the Alaska Native Claims Settlement Act (ANCSA) and the Alaska National Interests Land Conservation Act (ANILCA). Within the North Revilla Project Area, there are State land selections, which include parcels in Traitors Cove (VCU 737). In addition, there are USDA Forest Service administrative sites and lands being used under special use permits and mining claims. No timber harvest for the North Revilla project is being proposed on any of these encumbered lands.

State Selections

The State of Alaska, under the Statehood Act of 1959, is entitled to select up to 400,000 acres from the National Forests in Alaska. As of July, 1991, 57 percent of the entitlement has been conveyed. Most of the remaining acres have been selected and are in the process of being conveyed by the Bureau of Land Management. The selection within the North Revilla Project Area is in the Virgin Bay State Selection, AA-071621, NFCG 282 (440 acres). This selection was nominated by the Ketchikan Parks Advisory Board and the State Division of Parks and approved by the Regional Forester, August 28, 1989. This selection has not yet been conveyed. The Virgin Bay

selection is located on the northwest side of Traitors Cove, in Sections 18 and 19, T.71S, R.89E. Of the State selected lands, there are a total of 295 timber productive acres (122 in Volume Class 4 and 163 in Volume Class 5). Because the State of Alaska was granted the opportunity to select more lands than they were entitled to receive conveyance, some of these lands may become available for National Forest management in the future.

Private Land

Approximately 330 acres are in other ownership. These lands include private ownership in the area of Margaret Bay and Indian Point.

Native Selections

Native selections are authorized under 14(h)(8) of ANCSA. There are no Native selections within the North Revilla Project Area.

Special Use Permits

Several special use permits have been issued by the Forest Service for specific exclusive uses on National Forest System lands. These lands total 9.5 acres and include those facilities operated by the Southern Southeast Regional Aquaculture Association (SSRAA) in Neets Bay. Two kayak outfitter guides that have had permits with the Forest Service have identified West Behm Canal, Neets Bay, Traitors Cove and Hassler Island as part of their operating area.

Table 3-168 summarizes the special use permit sites within the Project Area.

Table 3-168
Summary of Special Use Permit Sites

Name of Permittee	Special Use	Legal Description	Management Area	Acres
SSRA*	dam and water pipeline	T70S, R91E, S22	K32	4
SSRA*	fish hatchery	T70S, R91E, S29	K32	4.5
SSRA*	tie down (fish net pens)	T69S, R91E, S33	K32	1

*SSRA - Southern Southeast Regional Aquaculture Association

Mining Claims

There are two mining claims for locatable minerals–'Brown Bear 1' (T70S, R91E, S26), and 'Ruth J.' (T72S, R89E, S13) within the Project Area.

Several historical mineral locations are documented by the U.S. Department of Interior, Office of Environmental Affairs, Anchorage, Alaska, Bureau of Mines' Minerals Availability System (MAS) database. These historic sites include two gold prospects, and two rockpits. One of these sites is reported as analogous to the

'Ruth J.'. The Bureau does not anticipate conflicts between future mineral development and the proposed logging developments.

Administrative Sites

There is a Forest Service administrative site, covering 15 acres at Margaret Bay.

Other Encumbrances

The Alaska Power Authority has a power site withdrawal which includes approximately seven miles of the lower river corridor. However, the site has not been identified by Alaska Power Authority or by scoping as having potential for development.

Effects of the Alternatives

None of the actions proposed by the alternatives will directly affect the status of existing special use permits or mining claims. Alternatives 2, 3 and 4 may require the issuance of new special use permits for camp developments. Alternatives 2, 3, 5, and 6 propose units in the vicinity of the Virgin Bay State Selection. No timber harvest will occur within the proposed Virgin Bay State Selection.

Permits and Easements

Logging adjacent to non-National Forest System lands may require easements and/or land use agreements for establishing tailholds or suspending logging cables over non-National Forest System roads, or land use agreements for establishing tailholds or suspending logging cables over non-National Forest System lands. It will also be necessary to directionally fall timber away from non-National Forest System lands. Alternatives which proposed locating timber harvest units or constructing roads near State, private, legislated LUD II lands or the Misty Fiords National Monument boundary may require updated land line surveys.

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ROADS AND FACILITIES

Key Terms

Access Management -acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands
Arterial Roads - roads usually developed and operated for long-term land and resource management purposes and constant service
Collector Roads - collect traffic from Forest Local roads; usually connect to a Forest Arterial road or public highway
Local Roads - provide access for a specific resource use activity such as a timber sale or recreational site; other minor uses may be served
Log Transfer Facility (LTF) - a facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft
Main Trunk Roads - primary roads that are used repeatedly for forest access over long periods of time
Modular Bridge - a portable bridge constructed of components that can be readily assembled and disassembled for movement from one site to another
Pre-haul Maintenance - work performed prior to use of a road for timber harvest activities; includes blading, shaping and brush removal
Temporary Roads - short term roads built for limited resource activity or other project needs
Traffic Service Levels - traffic characteristics and operating conditions that are used in setting road maintenance levels

Affected Environment

Introduction

The transportation system on Revillagigedo (Revilla) Island consists of many small isolated road systems scattered around the island and located close to the shoreline. These road systems are under the jurisdiction of either the federal, state, or local governments, or private interests. All roads in the Project Area are under the jurisdiction of the Forest Service. Timber harvest and related Forest Service management activities are the primary purposes for transportation development. These roads are isolated and do not connect with the greater Ketchikan road system.

The North Revilla Project Area contains no public transportation facilities (state highways, ferry dock, or airports). Currently, the Project Area has 108 miles of roads. Some of these roads were constructed prior to 1970 using low-design standards and are currently overgrown and are currently not usable.

Forest Transportation System

The Forest Transportation System includes three types of roads: arterials, collectors, and locals. Arterial and collector roads are usually maintained for use by passenger vehicles and are usually designed with more emphasis on mobility than local roads. Most local roads are not designed or maintained to accommodate passenger vehicles. Construction of roads for timber harvest activity varies from year to year on Revilla Island. In 1990-1991, approximately fifteen miles of local roads were constructed on Revilla Island.

The transportation system on Revilla Island can be broken into four categories: (1) State and Municipal roads (all state and municipal roads are outside the Project Area), (2) private roads (no private roads exist within the Project Area, 3) Forest Service Roads, and 4) Log transfer facilities (LTF's).

Forest Service Roads

There are approximately 240 miles of Forest Service roads on Revilla Island, 108 miles are within the Project Area. Since most of the roads do not connect to other existing road systems on Revilla Island, they are not maintained for passenger vehicles unless timber harvest operations are active. These single lane rough rock roads are primarily designed for heavy off-highway logging trucks.

Traffic service levels portray the expected traffic characteristics for forest roads in the Project Area. (see Appendix E, Transportation)

Table 3-169 displays the amount of miles of road by traffic service level and by alternative.

Table 3-169
Miles of Road By Traffic Service Level

	Traffic Service Level C		Traffic Service Level D	
Alt.	Existing	Planned	Existing	Planned
1	0.0	0.0	0.0	0.0
2	26.2	4.5	41.9	148.9
3	23.6	2.7	27.2	100.3
4	20.9	1.4	21.1	93.3
5	24.9	1.6	33.7	134.9
6	22.2	1.7	29.7	96.0

Maintenance Levels

Maintenance levels are based on the anticipated use of the roads. Because roads in the Project Area are isolated, predominantly intermittent resource management, off-road vehicular and foot traffic is expected.

Applicable maintenance levels for the Project Area are as follows:

Maintenance Level 1 (Traffic Service Level D)—Roads are closed by bridge removal or organic encroachment and are monitored for resource protection.

Maintenance Level 2 (Traffic Service Level C)—Roads are maintained for high clearance vehicles and monitored for resource protection.

During resource management activities, the roads will be maintained commensurate with that activity. After completion of the management activity these roads will revert back to the above maintenance levels.

Road Development

Road development patterns are similar from one alternative to another due to the location of resource being used, terrain characteristics, and development costs. Roads are located to minimize disturbance on the land, yet provide access to resources. Thus, road routes generally follow routes of favorable terrain where practicable.

Construction and Reconstruction of Roads

Three classes of road would be constructed as part of the proposed project, each class has different projected uses and construction standards. Temporary roads were considered Local roads for analysis purposes since these roads are similar to local roads.

Arterial and collector roads are generally mainline roads requiring higher standards and heavier investment to provide prolonged use. These roads can be built to lower standards initially and upgraded as use intensifies. Thus, the logging operator may construct arterial and collector roads to low or medium standards depending on use.

Forest roads are designed to varying standards depending on use.

Local roads are generally single purpose roads resulting in lower design standards and usually cost less than arterial and collector roads.

Road reconstruction consists of complete roadbed repairs, major culvert or bridge replacement, roadbed realignment, and/or resurfacing. All haul maintenance consists of ditch cleaning and road side brush removal roadbed surface blading and installation of minor pipes.

Construction and Reconstruction of Major Drainage Structures

Since the 1960's timber harvest activities has occurred in the Project Area. Until 1980, many of the drainage structures of the Forest transportation system were constructed from native materials which had a safe working life of 8-12 years. Consequently, existing roads will require reconstruction and drainage structure replacement. On both new and existing roads, modular bridges and permanent culverts will be used.

In situations where temporary roads cross Class III streams, temporary log stringer bridges may be used and removed upon completion of use.

Rock Quarry Disposition Locations

Generally rock borrow quarries are located every one to two miles along roads. The quarry location is determined by quality rock sources, haul distances, development costs, frequency of entry, and visual resource considerations. An allowance for rock quarries is included in the acres shown for road right of way clearing.

Some rock quarries are small, one-time uses, while others are expanded during future road building operations if quality rock is available.

Rock quarries with expansion potential will be retained for expansion, particularly in situations where potential roads and timber harvest may be developed in the future, or where numerous roads radiate out from a point near a centralized quarry. Rock quarries near the ends of the road system will be closed and reclaimed by spreading stockpiled overburden on the floor of the quarry.

Each quarry will be evaluated for disposition during the construction stage. Each quarry will be evaluated for the following: (1) availability of additional quality rock, (2) feasibility of expansion, (3) future rock resource needs in the area, and (4) proposed visual quality objectives.

Log Transfer Facilities (LTF's)

The transportation of harvested timber on Revilla Island requires that the log bundles be removed from the log trucks, placed in the water, and rafted to the sort yard at Thorne Bay and to the Ward Cove mill. Due to the isolated nature of the Project Area, this transportation will require the use of log transfer facilities (LTF's). Log Transfer Facility consolidation, by connecting to existing sites, is to be considered where feasible to minimize impacts to beach and marine zones. Consolidation would avoid the need to build LTFs on encumbered or state selected lands. Further analysis of LTF's is discussed in the Marine Environment and Log Transfer Facilities section of this chapter.

Effects of the Alternatives

The effects of the transportation system on other resources are considered in the sections relating to those resources (soil, water, visuals, fisheries, marine environment, etc.). This section focuses on the effects of each alternative on the transportation system, and will be grouped into the following categories: (1) Construction Costs, (2) Road Development, and (3) Access Management.

Table 3-170 displays the transportation development costs by alternative.

Table 3-170
Transportation Development Costs (in MM$) by Alternative

	Alternative 1	2	3	4	5	6
New Construction Miles **	0.00	153.4	103.0	94.8	136.5	97.7
Total Construction $	0.00	26.97	16.16	16.38	23.16	15.45
Reconstruction Miles	0.00	45.6	32.3	26.2	36.9	33.6
Total Reconstruction $	0.00	2.04	1.43	1.02	1.31	1.52
Bridge Construction/Reconstruction*						
Total Bridge Cost $	(0.00)	(1.66)	(1.10)	(0.40)	(0.97)	(0.93)
LTF Construction						
Chin Point	0.00	0.10	0.10	0.10	0.10	0.10
Total LTF Construction $	0.00	0.10	0.10	0.10	0.10	0.10
LTF Reconstruction						
Hassler	0.00	0.12	0.12	0.12	0.12	0.12
Klu Bay	0.00	0.04	0.04	0.04	0.04	0.04
Shrimp Bay	0.00	0.04	0.04	0.04	0.04	0.04
Fire Cove	0.00	0.04	0.04	0.04	0.04	0.04
SW Neets	0.00	0.02	0.02	0.02	0.02	0.02
Margaret	0.00	0.00	0.00	0.00	0.00	0.00
Total LTF Reconstruction	0.00	0.26	0.26	0.26	0.26	0.26
Total Construction and Reconstruction Cost	0.00	29.37	17.95	17.76	24.83	17.33

*Figures in parenthesis are included in construction and reconstruction cost
**Margaret Bay—Traitors Creek connection are not included in the above costs

Road Development

The position and spatial arrangement of resource areas and the amount of harvesting that would occur in new undeveloped areas requires changes in the road system. Proposed new roads are needed to harvest the timber volume associated with each alternative. A total of 376 miles of road would eventually be needed to harvest all timber in the project area. The total planned roads are the roads needed to harvest the remaining timber volume in the rotation associated with each alternative (see Table 3-171, 2140 Column). Road development includes expansion of the current road system in all action alternatives.

Table 3-171
Total Transportation Systems (Miles)

Alternative	Total Existing Roads	Existing Roads Used	Proposed Roads	Additional Roads Needed by Year 2140
1	107.8	0.0	0.0	268.0
2	107.8	68.1	153.4	114.6
3	107.8	50.7	103.0	165.0
4	107.8	42.0	94.8	173.2
5	107.8	58.6	136.5	131.5
6	107.8	51.9	97.7	107.3

Discrepancies may be found between tables due to rounding
SOURCE: Rhodes, 1992

Expansion of the road system requires: (1) Construction of varying classes of roads, (arterial, collector, and local); (2) reconstruction of some existing roads; (3) construction and reconstruction of varying types of major drainage structures; (4) construction coordination activities with other resource needs; and (5) proposed federal activities on State of Alaska Land Selections.

Construction and Reconstruction of Roads

The development of arterial collector roads occurs in all action alternatives. Alternatives 2 and 5 develop the most miles (153.5 and 136.5 respectively) and highest costs while Alternative 4 develops the least miles (94.8) and Alternative 6 the lowest costs. The level of local road development is not directly proportional to the level of harvest in each alternative, because of differing spatial arrangements of harvest units between alternatives.

The miles and cost of roads to be developed are shown by road class in Tables 3-172 and 3-173. Table 3-174 displays the miles of new road and major drainage structure costs.

Table 3-172
Existing Roads Proposed for Use

Road Class	Alternative 1	2	3	4	5	6
Arterial Miles	0	9.0	9.0	4.8	7.6	7.60
Collector Miles	0	17.6	13.2	14.1	17.7	13.2
Local Miles	0	41.5	28.5	23.1	33.3	31.1
Total	0	68.1	50.7	42.0	58.6	51.9

SOURCE: Rhodes, 1992

Table 3-173
Proposed Roads

Road Class	Alternative 1	2	3	4	5	6	Total Rotation (2140)
Arterial Miles	0	12.1	4.9	3.5	8.0	3.8	12.3
Collector Miles	0	13.3	6.5	10.5	11.1	6.5	13.3
Local Miles	0	128.0	91.6	80.8	117.4	87.4	242.4
Total	0	153.4	103.0	94.8	136.5	97.7	268.0

SOURCE: Rhodes, 1992

Table 3-174
New Road And Major Drainage Structure Costs*

Alternative	Miles	Cost (Million $)
1	0.0	0.00
2	153.4	26.97
3	103.0	16.16
4	94.8	16.38
5	136.5	23.16
6	97.7	15.45

SOURCE: Rhodes, 1992
* Margaret Bay - Traitor's Creek connection is not included

Reconstruction

Reconditioning of existing roads is associated with all action alternatives. Activities range from major realignment and bridge replacement to minor blading and shaping of the existing road from proposed harvest units to the existing LTF's.

Table 3-175 displays the miles and cost of heavy reconstruction for all alternatives. Pre-haul maintenance is not displayed as it is assumed all roads require some minor surface blading and ditch cleaning prior to commencement of log hauling operations.

Table 3-175
Road Reconstruction

Alternative	Miles	Cost (Million $)
1	0.0	0.00
2	45.6	2.04
3	32.3	1.43
4	26.2	1.02
5	36.9	1.31
6	33.6	1.52

SOURCE: Rhodes, 1992

Margaret Bay — Traitors Creek Road Construction

Connecting the Margaret Bay and Traitors Creek road systems would improve Forest administration access and reduce costs. This would eliminate the need for Forest administrative facilities in the Fire Cove and upper Traitors Creek areas. The connection could reduce the need for a floating logging camp at Fire Cove which may reduce environmental impacts. This would not eliminate the need for use of both Fire Cove and Margaret Bay LTF sites as both will be used concurrently.

The Margaret Bay-Traitors Creek connection is included in Alternative 2. Table 3-176 displays the miles of road and additional costs for the Margaret Bay-Traitors Creek road connection for each alternative. This road connection is not needed to haul timber harvest units in the action alternatives.

Table 3-176
Margaret Bay-Traitors Creek Road Connection

Alternative	Number of Miles	Costs (Million $)
1	0.0	0.00
2	1.0	0.35
3	1.7	0.52
4	0.0	0.00
5	2.5	0.71
6	1.7	0.52

SOURCE: Rhodes, 1992

Road Connections to Eliminate LTF sites

If road connections between LTF tributary areas are feasible and practical, LTF sites can be eliminated. It is feasible to connect proposed NW Traitors LTF (Site No. 18) and N. Traitors LTF (Site No. 22) to existing LTF (Site No. 17) at SW Neets Bay.

Connection of NW Traitors LTF (Site No. 18) to SW Neets Bay LTF (Site No. 17) would eliminate the need to construct roads and an LTF on state selected land. The connection would reduce marine impacts and disturbance to the beach zone by 1.2 and 1.5 acres, respectively.

Connection of N. Traitors LTF (Site No. 22) to SW Neets Bay (Site No. 17) would eliminate the need to construct an LTF, reduce marine impacts by 1.2 acres, and reduce disturbance in the beach zone by 3.7 acres.

There are two possible routes for connecting N. Traitors LTF (Site No. 22) to SW Neets Bay LTF (Site No. 17). Both are shown in the Alternative 6 Map. Both routes have compatible effects over the long and short term. Over the short term, approximately the same amount of road length and acres of land area would be effected regardless of which route was selected. Over the long term, by the year 2140,

95 percent of both connecting routes would be built to serve the available harvestable timber resources in the area. Accordingly, the amount of road miles and acres of land impacted would be approximately the same. Thus, final route selection will be made in the implementation phase based upon final survey and design information.

Construction Coordination with Fish and Wildlife

Development in numerous areas will require road construction near inventoried eagle nest trees. Road construction is anticipated to be within 330 feet of one or two eagle nest trees in the Project Area, depending on the alternative. There are 1,260 feet of planned roads within a 330 foot radius of an eagle tree in Alternatives 2, 3, 5, and 6, with 660 feet in Alternative 4.

In accordance with an agreement between the U.S. Forest Service and the U.S. Fish and Wildlife Service, specific criteria concerning road construction within 1/2 mile of an active eagle's nest is implemented to mitigate disturbance to eagles. Table 3-177 displays the planned, existing, and reconstruction miles within the 1/2 mile zone.

Table 3-177
Road Activities within 1/2 Mile of Inventoried Eagle Nests

	Existing		Reconstruction		Proposed	
Alternative	Miles	Acres	Miles	Acres	Miles	Acres
2	7.7	70	3.5	32	17.9	163
3	7.7	70	3.6	33	14.4	131
4	6.9	62	3.5	31	10.3	94
5	7.2	66	3.6	33	15.7	143
6	7.3	66	3.4	31	13.4	122

SOURCE: Rhodes, 1992

Road construction requires numerous stream crossings. Many of the streams are habitat for various fish species. It is necessary to minimize impacts on these streams to protect salmon fry and eggs. Maintaining fish passage characteristics and scheduling construction activities (fish timing) around fish movements are methods used in mitigating impacts of roads on streams.

Some stream crossings have been identified as needing fish timing restrictions for construction of structures, to minimize impacts on fish eggs and fry. Generally, these restrictions can be accommodated through planning and scheduling of the construction activities. In many cases, additional costs would be incurred to accommodate the timing restrictions. Such costs would include additional equipment mobilization and demobilization, increased construction actions for mitigation and increased construction delays. The number of crossings, the acres of RP buffers affected by road crossings, and the number of crossings with fish timing and/or passage restrictions are displayed in Table 3-178 and 3-179. It is estimated that approximately 250 feet of road is involved in crossing a RP Class I and II stream and buffer; 200 feet for the

buffer crossing and 50 feet for the stream channel crossing. RP Class III crossing miles and acres are not shown.

Table 3-178
Number of Proposed RP Stream Crossings

RP Crossing	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Total Rotation (2140)
RP Class I	0	44	28	29	42	27	62
RP Class II	0	64	54	33	55	49	75
RP Class III	0	219	147	116	186	124	346
Total Crossings	0	327	229	178	283	200	483

SOURCE: Rhodes, 1992

Table 3-179
RP Stream Crossings by Number of Crossings and Miles and Acres Affected*

Alternative	No. of Crossings	Miles	Acres
2	108	5.1	46
3	82	3.9	35
4	62	2.9	27
5	97	4.6	42
6	76	3.6	33
Total Rotation	137	6.5	59

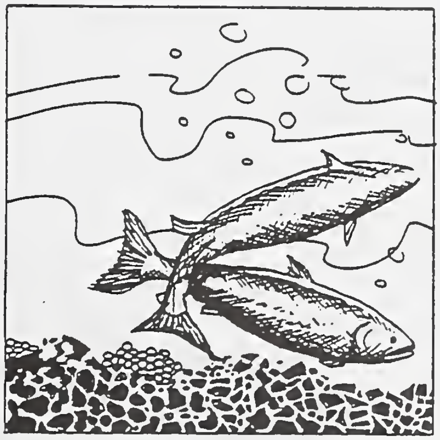
SOURCE: Rhodes, 1992
* Road clearing width is estimated to be an average of 75' wide including rock pits.

The fish timing, passage, non-passage crossings, and associated fish timing costs for the Project Area are displayed in Table 3-180. VCU specific locations for fish timing are located in the Planning Record.

Table 3-180
Number of Crossings with Fish Timing and/or Passage Restrictions

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Total Rotation
Timing and Passage	0	37	24	26	30	26	47
Passage	0	106	77	68	99	75	137
Non-Passage	0	219	148	116	171	131	346
Cost MM$	0	0.38	0.25	0.27	0.31	0.27	0.48

SOURCE: Rhodes, 1992
* These costs are included in the total road construction and reconstruction costs in Table 3-RFx.



Road Construction Within TTRA and RP Prescription Zones

Roads will be located within stream zones where it is the environmentally preferred choice and where it is consistent with safety regulations. When these roads are designated on the ground, care will be taken to keep as much of the road as possible outside TTRA and RP Prescrption Zones. In most cases, the limiting factor will be the type of terrain adjacent to the various zones stream which will govern how much of a given road segment can be located outside these zones.

Some road development inside the TTRA and RP Prescription Zones is unavoidable. For example, roads accessing log transfer sites will require location in beach and, in some cases, estuarine zones.

Tables 3-181 through 3-186 display the planned and existing miles and acres of roads in the TTRA and RP Prescription Zones. The existing mileage shown in Tables 3-181 through 3-186 includes only the existing miles of road used in the alternatives. There are additional existing roads in the Project Area that are not proposed in the alternatives. VCU specific location for road development in the various buffers are included in Appendix E. For a discussion of stream buffers, see Chapter Two, Mitigation Measures.

Table 3-181
Road Development in Stream Zones

	Existing Roads Used		Planned	
Alt.	Miles	Acres	Miles	Acres
1	0.0	0	0.0	0
2	3.3	30	1.5	14
3	1.3	12	0.8	8
4	2.0	18	0.8	7
5	2.3	21	1.1	10
6	2.4	22	1.0	9

SOURCE: Rhodes, 1992

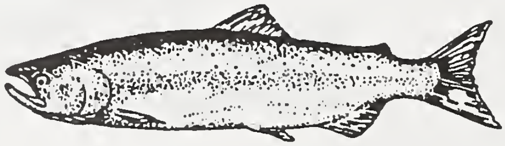


Table 3-182 displays the existing and proposed road development affecting the TTRA lake zones.

Table 3-182
TTRA Lake Zones Affected by Roads

Alt.	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0.0	0	0.0	0
2	0.1	1	0.2	1
3	0.1	**	0.1	1
4	0.0	0	0.1	1
5	0.0	0	0.2	1
6	0.0	0	0.1	1

** Less than one acre.
SOURCE: Rhodes, 1992

Table 3-183 shows the existing and proposed road development affecting the RP Lake Prescription zone.

Table 3-183
RP Lake Prescription Zones Affected by Roads

Alt.	Existing Roads Used Mi.	Existing Roads Used Ac.	Planned Mi.	Planned Ac.
1	0.0	0	0.0	0
2	2.3	21	4.8	43
3	1.6	14	1.8	17
4	1.7	15	1.6	14
5	2.1	20	4.1	38
6	1.4	12	1.6	14

SOURCE: Rhodes, 1992
Note: Includes both no-cut and partial cut zones

Table 3-184 displays the existing and planned roads affecting the Estuarine Zones development. (1000 feet)

Table 3-184
Estuarine Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0.0	0	0.0	0
2	2.1	19	2.0	18
3	1.6	15	0.7	6
4	2.1	19	1.0	9
5	2.1	19	1.2	10
6	1.6	14	0.7	6

SOURCE: Rhodes, 1992

Table 3-185 portrays the existing and planned road development affecting the beach zones. (500 feet)

Table 3-185
Beach Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0.0	0	0.0	0
2	0.8	8	1.5	14
3	0.8	7	1.4	12
4	0.5	5	0.6	5
5	0.8	8	1.4	12
6	0.8	7	1.4	12

SOURCE: Rhodes, 1992

Table 3-186 shows the existing and planned road development affecting the RP stream prescription (no cut) zones. (100 feet)

Table 3-186
RP Stream Prescription (No Cut) Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0.0	0	0.0	0
2	1.7	15	0.1	1
3	1.5	14	0.1	1
4	1.0	9	0.1	1
5	1.3	14	0.1	1
6	1.5	13	0.1	1

SOURCE: Rhodes, 1992

Table 3-187 Portrays the existing and planned road development affecting the RP stream prescription (Partial-Cut) Zones.

Table 3-187
RP Stream Prescription (Partial Cut) Zones Affected by Roads

Alternative	Existing Roads Used Miles	Existing Roads Used Acres	Planned Miles	Planned Acres
1	0.0	0	0.0	0
2	0.4	3	0.2	1
3	0.4	3	0.1	1
4	0.1	1	0.0	0
5	0.3	3	0.2	1
6	0.4	3	0.0	0

SOURCE: Rhodes, 1992

Proposed Activities on State Land Selections

No road or LTF development will take place within state land selections.

Utility Corridor

The Tongass Land Management Plan Revision team has mapped the transportation and utility corridors on the Tongass National Forest. The maps show two corridors passing through the Project Area. The Alaska Legislature passed Senate Joint Resolution (SJR) 40 in the 1992 session urging the Forest Service not to preclude of any of the transportation and utility corridors identified by an interagency group. The transportation and utility corridors are being considered in the current TLMP Revision process.

The IDT evaluated the action alternatives and SJR 40, and determined that none of the action alternatives would preclude the identified transportation and utility corridors within the forseeable future.

The *Lake Tyee to Swan Lake Transmission Intertie* (R.W. Beck amd Assoc., 1992) presents a feasible electric power transmission line route through the Project Area via Neets Creek and Klam Creek drainages (see Figure 3-64).

The Ketchikan Gateway Borough and the Alaska Department of Transportation and Public Facilities cooperated in an examination of the highway corridor opportunities. The *Ketchikan - Revillagigedo Island Corridor Study*, R&M Engineering, 1992; identified a preferred highway route that passes through the Project Area on the north side of Orchard Lake and through Klam Creek. On the basis of aerial reconnaissance and examination of high resolution contour maps, the Ketchikan Administrative Area IDT has done preliminary identification of an alternative route that parallels the electric transmission route to Shrimp Bay. This alternative route uses a ferry terminal at Shrimp Bay as an alternative to the route on the north side of Orchard Lake and some difficult terrain north of Shrimp Bay.

The effects of the possible construction of the power line within the Project Area have primary effects on the visual resource. The clearing of the corridor along the transmission lines can be seen from a number of view points.

The actions proposed in the Project Area could benefit the transmission project by incidental transportation and logistic uses. The construction of the transmission across National Forest System lands normally requires removal of all merchantable timber felled along the corridor. The road system would allow shorter flights for helicopters removing the timber thus reducing cost. The roads will also shorten transportation by helicopter for towers, cable, and other logistics and is expected to result in a reduction of costs.

The IDT considered these routes and evaluated them for likelihood of construction within the forseeable future. For purposes of the evaluation, forseeable future was considered to be the life of the Tongass Land Management Plan Revision (10-15 years).

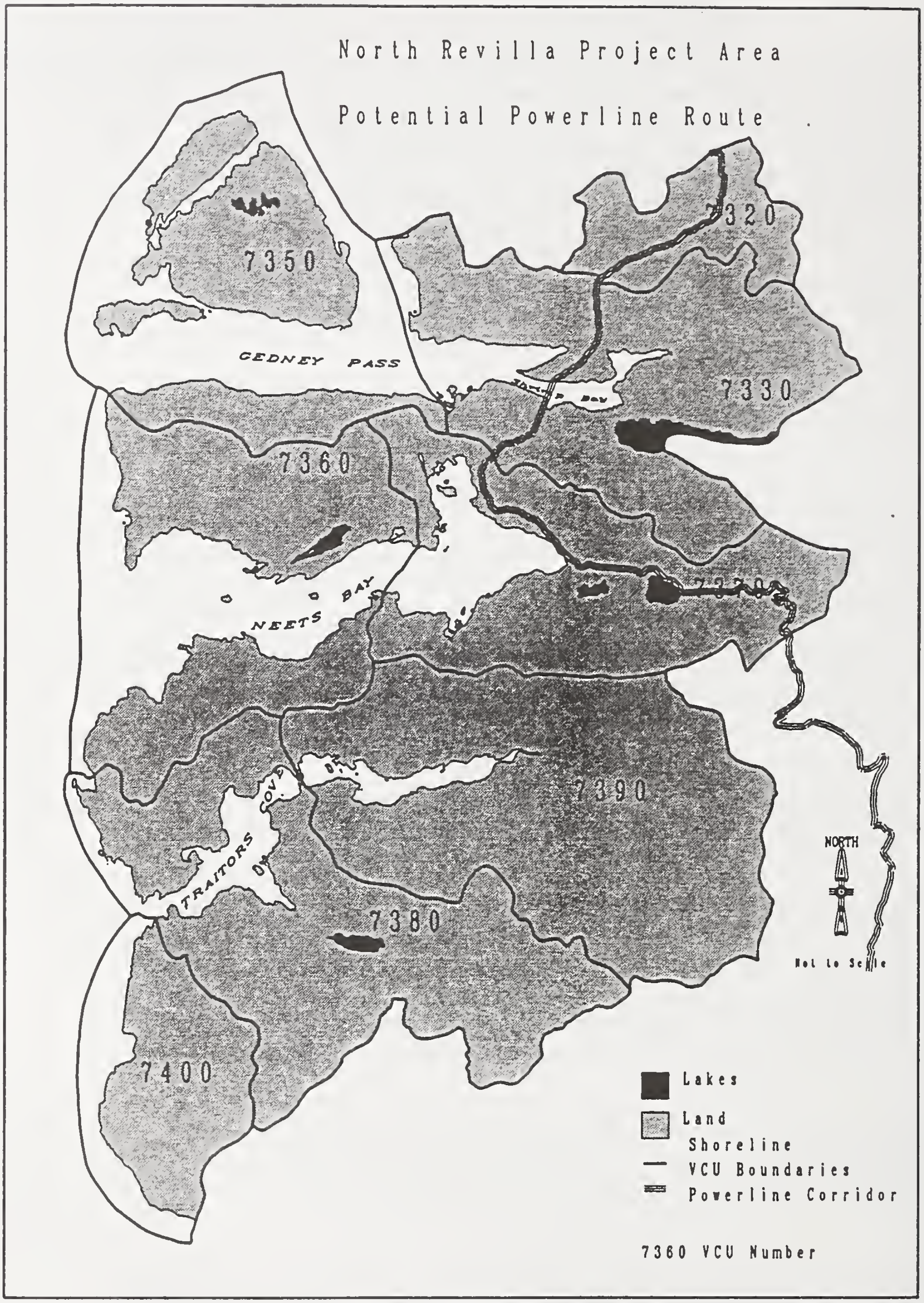
The electrical transmission line was examined in light of overall mission of the effort, history of funding of such projects, and difficulty of accomplishment. By comparison to other power transmission projects within Alaska and possible funding, the IDT

concluded that the construction of the power line was likely within the forseeable future.

The IDT examined the highway corridors using the history of highway development on Prince of Wales Island, of highway corridors between communities in Southeast Alaska and the history associated with construction of roads through TLMP LUD II areas as a model. The probable direction of construction along the corridor (Ketchikan northward, Behm Canal southward, or sections in the middle) were evaluated. The IDT concluded that the most likely direction of construction was from Ketchikan northward. Using the rate of progress of state highway development on Prince of Wales Island as a guide, the road construction would not reach the Project Area within the forseeable future. The IDT also noted that the Forest Supervisor has made a determination that the construction of a road from Ketchikan to Shelter Cove was not in the forseeable future.

Figure 3-64 illustrates the proposed utility corridor.

Figure 3-64
Proposed Utility Corridor



Other Facilities within the Project Area

The Forest Service maintains a permanent 16-person work center and a temporary boat/plane float at Margaret Bay and a permanent boat/plane float structure adjacent to the Fire Cove LTF.

Some reconstruction will be needed for the LTF at Margaret Bay. Complete replacement of the temporary small boat/plane float is required. The existing float is unsafe for docking planes due to the configuration and location of the structure.

The U.S. Navy Southeast Alaska Accoustic Measurement Facility is located in Behm Canal between Ketchikan, Alaska and the project area. Log raft, equipment transport, and camp mobilization will require towing operations through the Southast Alaska Accoustic Measurement Facility area. Towing operations will require coordination with operation of the accoustic facility. Approximately 80 to 100 tow trips are expected for transporting timber resources from the project area to processing centers. Some tow delays may be expected.

Access Management

In all the proposed action alternatives access to the road system is by boat or float plane. Due to these limits, vehicular use is expected to be negligible except for some use of off-highway vehicles. Consequently, access management will consist of managing roads for administrative activities. (Road Maintenance Levels 1 and 2).

Some administrative activities include: salvage harvest, post sale silvicultural, monitoring and maintenance of the Margaret Creek Fish Pass, and fish hatchery access.

Road Disposition

Roads are closed for numerous reasons, including fish and wildlife protection, public safety, and inadequate maintenance funding. It may be necessary to close roads or portions of roads to use by specific vehicle types. Roads under Forest Service jurisdiction can be closed by authority of CFR 36, ch.11, parts 212.7 and 261. Road closure orders will be posted at the Ketchikan Ranger District office.

Some main trunk roads will be kept open to meet long-term objectives. Secondary roads will be left open and seeded to retard alder growth. Maintenance of these will consist of monitoring road and drainage structures for functional and environmental condition. Permanent drainage structures will be installed to meet long-term access objectives; however, maintenance levels fluctuate in response to changing uses. During periods of limited use, maintenance standards are sufficient to provide only for public safety and resource protection. Post sale road management objectives are to keep the road open by leaving portable bridges in place to facilitate administrative activities such as reforestation and precommercial thinning. Maintenance Level 2 will be applied to these roads.

The remaining local roads will be left open except those with bridges. The bridges will be removed and used in other locations. The local roads being left open will not be maintained for vehicular traffic, however, drainage structures will be monitored for functional condition. In general, these roads will grow closed organically resulting in closure to vehicular traffic. Maintenance Level 1 will be applied to these roads.

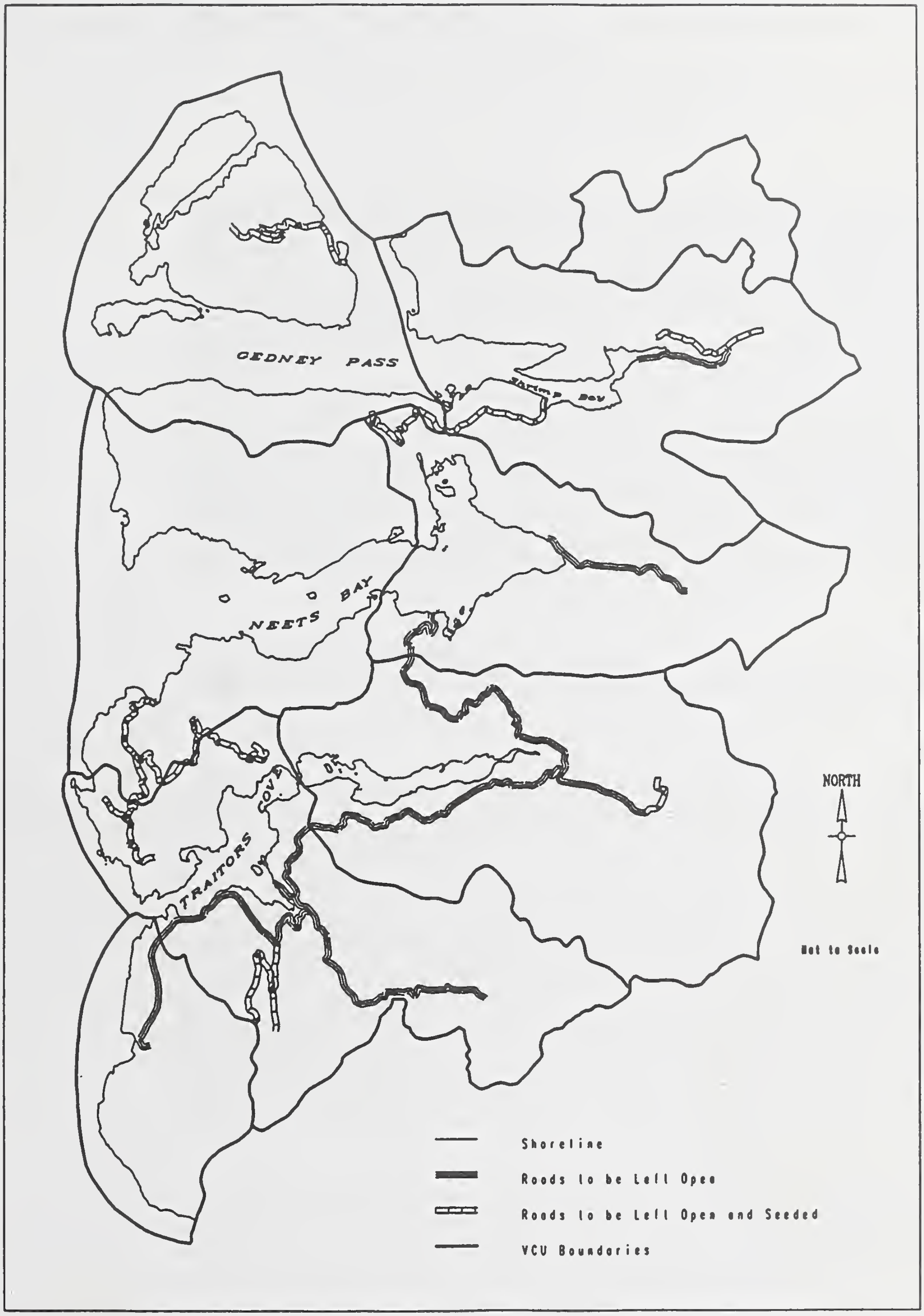
Temporary roads are not being retained on the permanent transportation system. These roads will be closed by removing structures, construction of water bars and

revegetated in accordance with NFMA. Temporary roads were not shown separately as they are included in local road figures.

Alternatives 2, 3, 5, and 6 propose similar management activities. Alternative 4, however, would not enter the Traitors Creek portion of the Fire Cove road system to maintain low hunting and trapping pressures in these areas. Accordingly, the Traitors Creek road system would not be re-opened under Alternative 4.

Figure 3-65 displays the arterial and collector roads that are to remain open with limited maintenance, roads to be seeded to retard against alder growth. Roads not maintained for vehicular traffic will grow closed organically and are not displayed in Figure 3-65 but are illustrated in the alternative map packet.

Figure 3-65
Road Access Map



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MARINE ENVIRONMENT, LOG TRANSFER SITES AND RELATED FACILITIES

Key Terms

A-Frame LTF - log transfer facility system which consists of a stationary mast with a falling boom for lifting logs from trucks to water. This system is generally located on a shot rock embankment with a vertical bulkhead to access deep water, accommodating operations at all tidal periods
Low-angle ramp LTF - log transfer facility system which consists of a drive-down slide ramp with slide rails for pushing log bundles into the water
Log Transfer Facility (LTF) - a facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft
Marine Benthic Habitat - the area occupied by the aggregate of organisms living at or on the bottom of a water body

Affected Environment

Marine Environment

Southeast Alaska's coastline consists of approximately 30,000 miles of tidal shoreline, roughly 60 percent of the total Alaskan coast. Within this region occurs a great diversity of habitats that collectively account for the complexity of Southeast Alaska's estuary and tidal environments.

The marine environment encompasses a wide variety of ecosystems. The intertidal and subtidal marine environments are subject to effects from log transfer and storage facilities; those are the points of concentrated activity associated with the marine transportation of logs. The preferred sites for log transfer facilities, (LTF's) log storage areas, camp settlements, and anchorages are deep bays or along straits or channels. Other marine areas are not addressed here because they are not expected to be affected by activities associated with the timber harvest of this project. Activities outside the areas of concentration are widely dispersed. Any potential effects would be short term and/or diluted below detectable thresholds.

The shallow marine waters and associated mud flats and estuaries found in the protected coves and bays provide habitat for some important species such as Dungeness crab and juvenile salmon. They are part of a complex and dynamic ecosystem that includes shrimp, flatfish marine worms, echinoderms, sponges, sea anemones, shellfish, plankton, marine algae, and other organisms.

Log Transfer Facilities (LTF's)

The transportation of harvested timber on the Project Area requires that the logs must be trucked or flown to the ocean, transferred to the water or barges at a log transfer facility (LTF) and towed to Thorne Bay for sorting. They are then moved to processing sites like the pulp mill at Ward Cove or the sawmill at Metlakatla.

There are eleven existing LTF's within the Project Area that were constructed from the 1950's to the 1980's. LTF's from the 1950's and 1960's will require major modification or relocation to meet the current State and Federal permit requirements. All LTF's are owned by the Forest Service.

Table 3-188 displays the existing LTF locations and the decade of construction.

Table 3-188
Existing LTF's Within the Project Area

Facility Location	LTF No.	Active Facility	Decade of Constructions 1950's	1960's	1970's	1980's
Hassler Island	2	No			X	
Dress Point	3	No		X		
Klu Bay	4	No			X	
Shrimp Bay	5	No			X	
Chin Point	6	No		X		
North Neets	8	No			X	
Clam Island	10	No			X	
Same Cove	11	No			X	
East Neets	15	No	X			
SW Neets Bay	17	No				X
Margaret Bay	24	No		X		

SOURCE: Rhodes, 1992

Figure 3-66 and Table 3-189 display the locations of existing and proposed LTF's in the Project Area.

Figure 3-66
Existing and Proposed LTF's for Each Alternative

● Existing LTF
▲ Proposed LTF
✖ Helicopter to Barge
Project Boundary
Shoreline
Roads

NAME	LTF#	Alternative	NAME	LTF#	Alternative
Chin Point	6	None	Margaret Bay	24	2,3,4,5,6
Chin Point	7	2,3,4,5,6	North Neets	8	None
Chin Island	10	None	North Neets	9	None
Dress Point	3	None	North Traitors	22	None
East Neets	15a	None	North Traitors	23	None
East Neets	15	None	N.W. Traitors	18	None
Easy 12	12	None	N.W. Traitors	19	None
Easy 13	13	None	N.W. Traitors	20	None
Easy 14	14	None	N.W. Traitors	21	None
Fire Cove	16	2,3,4,5,6	S.W. Neets	17	2,3,5,6
Hassler	1	None	Same Cove	11	None
Hassler	2	2,3,4,5,6	Shirmp Bay	5	2,3,4,5,6
Klu Bay	4	2,3,4,5,6	Gedney	27	2,4,6
Clam Island	25	None	Gedney	28	2,4,6
Same Cove	26	2,4,6	Gedney	29	4

Table 3-189
LTF Locations

Location	Site #	Latitude	Longitude
Hassler	1	55° 52' 57"N	131° 36' 07"W
Hassler Island	2	55° 52' 17"N	131° 35' 21"W
Dress Point	3	55° 51' 26"N	131° 33' 21"W
Klu Bay	4	55° 50' 30"N	131° 27' 18"W
Shrimp Bay	5	55° 49' 57"N	131° 29' 57"W
Chin Point	6	55° 47' 59"N	131° 40' 53"W
Chin Point	7	55° 48" 00"N	131° 40" 19"W
North Neets	8	55° 47' 59"N	131° 38' 48"W
North Neets	9	55° 47' 29"N	131° 38' 36"W
Clam Island	10	55° 47' 29"N	131° 38' 55"W
Same Cove	11	55° 47' 52"N	131° 34' 19"W
Easy	12	55° 48' 05"N	131° 33' 07"W
Easy	13	55° 48' 13"N	131° 33' 12"W
Easy	14	55° 48' 16"N	131° 33' 13"W
East Neets	15	55° 47' 24"N	131° 29' 34"W
Fire Cove	16	55° 46' 29"N	131° 33' 19"W
SW Neets	17	55° 45' 08"N	131° 41' 24"W
NW Traitors Cove	18	55° 42' 22"N	131° 40' 23"W
NW Traitors Cove	19	55° 42' 43"N	131° 40' 19"W
NW Traitors Cove	20	55° 43' 21"N	131° 39' 38"W
NW Traitors Cove	21	55° 43' 30"N	131° 39' 52"W
N. Traitors Cove	22	55° 43' 44"N	131° 38' 39"W
N. Traitors Cove	23	55° 43' 57"N	131° 38' 01"W
Margaret Bay	24	55° 42' 04"N	131° 38' 01"W

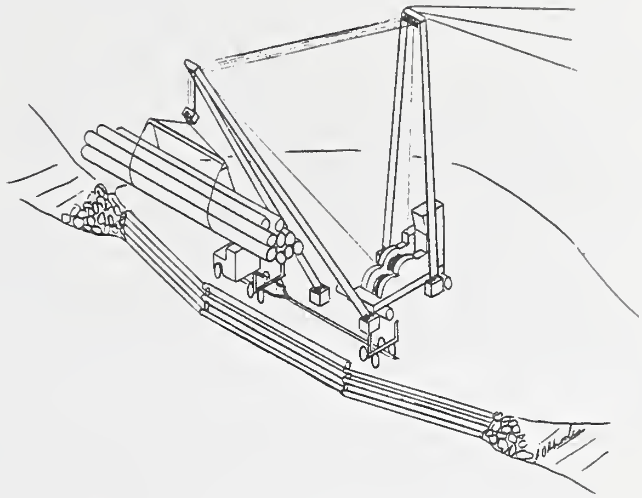
SOURCE: Rhodes, 1992

Log Transfer Methods

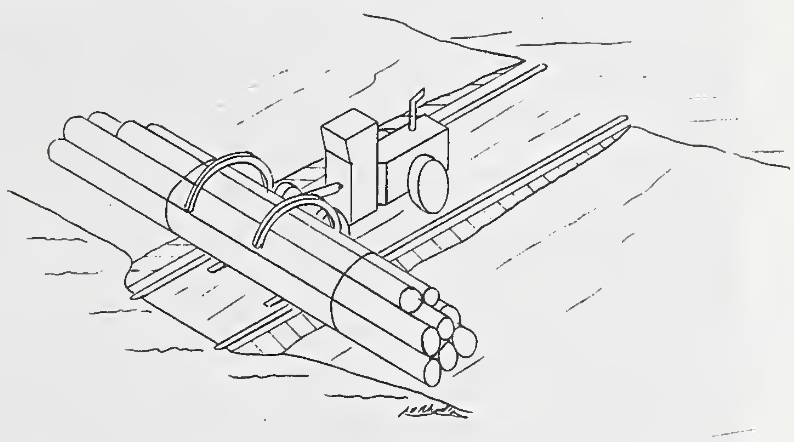
Four log transfer methods are considered in this analysis. These are: (1) low-angle ramp with rafting facilities, (2) A-Frame type entry device with rafting facilities, (3) a dry land to barge transfer facility and, (4) helicopter placement of logs directly into the ocean or onto a barge.

The **A-frame** method generally consists of a stationary mast with a falling boom for lifting logs from trucks to water. This system is generally located on a shot rock embankment with a vertical bulkhead to access deep water, accommodating operations at all tidal periods.

A modified version of this method uses a stationary A-frame boom with sloping guide rails placed on the bulkhead to guide the logs to deep water at lower tidal levels.



The **Low-Angle Ramp** method consists of a shot rock ramp sloped at 10 to 20 percent grade with wood or steel rails on the ramp surface. Log bundles are walked down the ramp into the water by use of a rubber-tired log loader.



The **Land to Barge** transfer system requires a deep water bulkhead for barge mooring facility. Draughts of up to 25 feet are required for barge operations. Logs are loaded directly on to the barge by use of a loader. Barges can also be loaded with logs floating in the water by use of onboard cranes. Land to barge operations were not utilized in the final analysis because of high operating costs and impacts of rebuilding the existing LTF's to accept barges. Most of the sites in the project area will be handling small volumes of timber and use of barges is economically prohibitive.

The **helicopter** transfer of logs to water transportation modes consists of moving logs from the harvest area directly to the water. The logs are placed in a containment area (bag boom), then moved by boom boat to the raft or sort yard. A modification of this system is to fly logs directly to a barge.

Each LTF requires a log transfer area, a small airplane and boat dock, an equipment off-loading ramp, and a log raft storage area. These facilities are generally located within close proximity of the LTF to reduce costs and retain impacts within a localized area.

Sites Considered in Detail

There were 13 sites considered in detail but some were eliminated for terrain or environmental reasons. The sites are divided into three general areas: Hassler Island and Shrimp Bay, Neets Bay, and Traitors Cove. Figures 3-67 through 3-69 illustrate investigated and preferred sites for each alternative.

Based upon Forest Service wetland maps, two existing LTF's are located within forested wetlands. These are Hassler Island No. 2 and Fire Cove No. 16. All other existing LTF sites are on non-wetland sites. Hassler Island No. 2 and Fire Cove No. 16 can both be reconstructed within the existing site.

Figure 3-67
LTF Sites for Hassler Island and Shrimp Bay

	NAME	LTF#	Alternative
	Dress Point	3	None
*	Hassler	1	None
**	Hassler	2	2,3,4,5,6
	Klu Bay	4	2,3,4,5,6
	Shrimp Bay	5	2,3,4,5,6
	Gedney	27	2,4,6
	Gedney	28	2,4,6
	Gedney	29	4

○ Investigated Site
● Preferred Site
✖ Helicopter to Barge

NORTH

Not to Scale

* Only one LTF needed
** Existing Lease

Hassler Island and Shrimp Bay

Sites Considered but Eliminated from Detailed Study

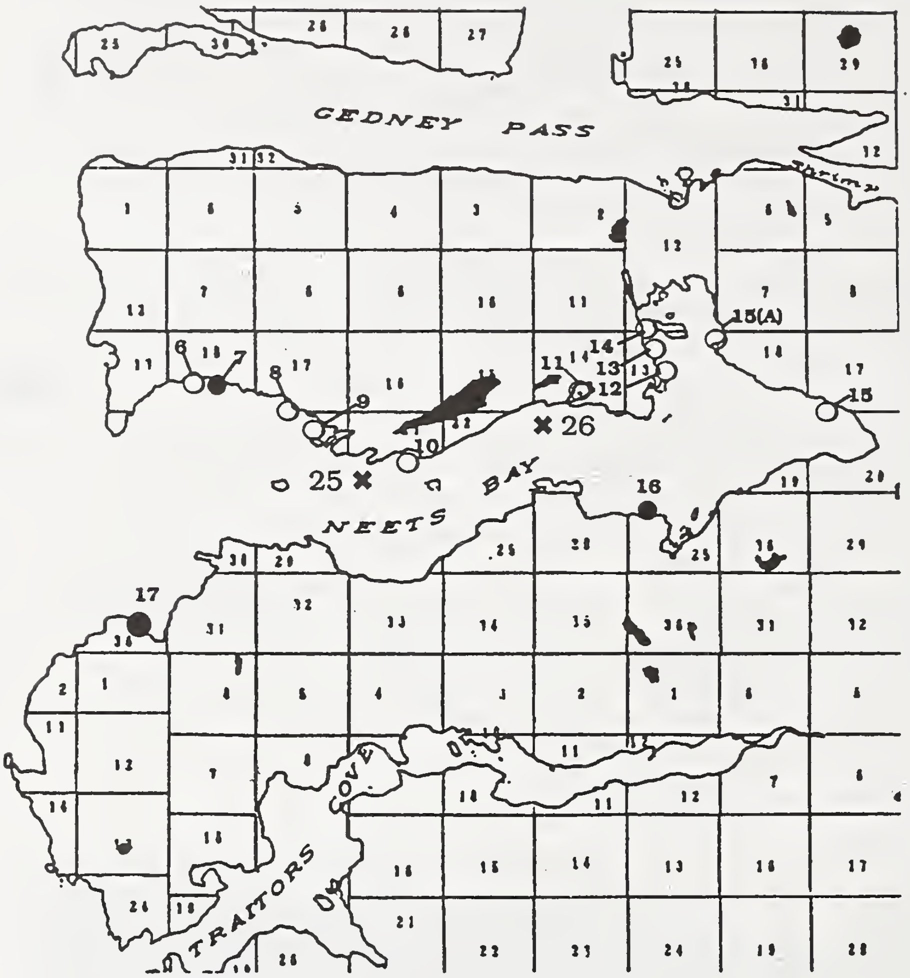
North Hassler: Site No. 1 contains an eel grass bed and was not considered in detail to avoid high-value marine habitat. It also did not meet the Alaska Timber Task Force guidelines. (See Appendix E)

Sites Considered in Detail

Hassler Island: Site No. 2 is an existing site that would access timber on Hassler Island. This site was considered biologically acceptable by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Site No. 2 will be developed as an A-frame lift-off system. This site best meets the Alaska Timber Task Force guidelines. This site may be within a forested wetland.

Gedney: Site No.'s 25, 26 and 27 serve small non-roaded areas adjacent to Gedney Pass. These areas would be served by use of helicoptor to move logs from land to a log boom or barge.

Figure 3-68
LTF Sites for Neets Bay



	NAME	LTF#	Alternative		NAME	LTF#	Alternative
*	Chin Point	6	None	**	Fire Cove	16	2,3,4,5,6
*	Chin Point	7	2,3,4,5,6	*	North Neets	8	None
	Chin Island	10	None	*	North Neets	9	None
	East Neets	15a	None	**	S.W. Neets	17	2,3,5,6
	East Neets	15	None	*	Same Cove	11	None
*	Easy 12	12	None		Clam Island	25	None
*	Easy 13	13	None		Same Cove	26	2,4,6
*	Easy 14	14	None				

O Investigated Site
● Preferred Site
✖ Helicopter to Barge

* Only one LTF needed

Neets Bay

Sites Considered, but Eliminated from Detailed Study

Chin Point: Site No. 6 is located on the northwest side of Neets Bay. The site was eliminated because of its proximity to a salmon spawning stream, which does not meet Alaska Timber Task Force guidelines.

NW Neets: Site No. 8 and Site No. 9 are located on the northwest side of Neets Bay. These sites were not considered further because of poor site development, and bathymetric characteristics. These sites do not meet Alaska Timber Task Force guidelines.

Easy Sites No.'s 12, 13, and 14: These sites are located on the west shore of northeast Neets Bay and were not considered further because of poor site bathymetric (water measurements) characteristics and excessive upland disturbance that would be caused by the access road. These sites do not meet the Alaska Timber Task Force guidelines.

East Neets: Site No. 15 is located at the east end of Neets Bay within the Neets Bay fish hatchery. The existing LTF, camp access ramp, and barge off-loading area are being used for hatchery operations. It is expected that log transfer, raft, and booming operations would create undesirable interference to fish rearing pens.

Site No. 15 is adjacent to high-value estuarine habitat and eliminated because of expected operational interference and proximity. This site does not meet the Alaska Timber Task Force guidelines.

Northeast Neets: Site No. 15a is located on the northeast shore of Neets Bay and would avoid SSRAA fish hatchery operations at Neets Bay. This site would require approximately 2.5 miles of additional road. This site is on non-wetland site.

A route from Neets Creek valley to Shrimp Bay via East Neets Bay is being considered for a power transmission corridor. A road connecting Neets Creek valley and Shrimp Bay is feasible and would serve both power transmission corridor and timber managements access. The Neets Creek valley to Shrimp Bay road connection would eliminate the need for Site No. 15a as Shrimp Bay Site No. 5 would serve the Neets Creek valley area.

To consolidate LTF's and develop a road connection was not considered for Site No. 15a.

Sites Considered in Detail

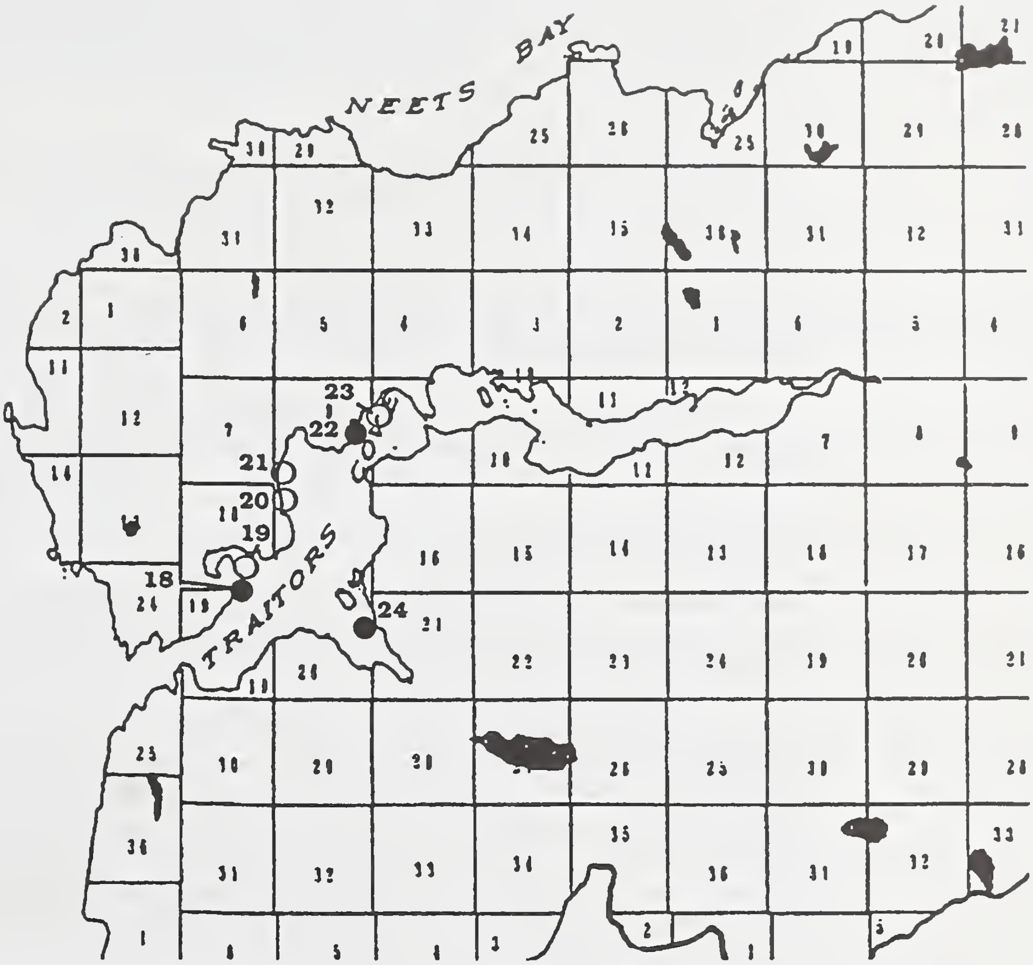
Chin Point: Site No. 7 is located on the northeastern side of Neets Bay and has been impacted by past timber harvest activities, both on the uplands and in the marine environment. This site is preferable as it met current Alaska Timber Task Force guidelines concerning proximity of anadromous fish streams and eagle trees. Site No. 7 was considered biologically acceptable by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. This site best meets the Alaska Timber Task Force guidelines. This area is not a wetland.

Clam Island: Site No. 10 is an existing site serving a small area located on Revilla Island on the north central side of Neets Bay. Use of this site would retain impacts to a previously impacted area. Thus, Site No. 10 was retained for planned operations in

this project. If the area tributary to Site No. 10 is logged by helicopter, logs will be flown directly to the water. This would eliminate use of the LTF; however, the rafting area adjacent to Site No. 10 would be used. Site No. 25 would serve as the Clam Island helicopter to barge transfer area.

Same Cove: Site No. 11 is located in a very small cove on the north central part of Neets Bay. Site No. 11 is an existing site serving a very small area. Use of this site would retain impacts in a previously impacted area. Thus, Site No. 10 was retained for planned operations in this project. If the area tributary to Site No. 11 is logged by helicopter, logs will be flown directly to the water outside of the small cove. This would eliminate use of the LTF; however, a rafting area in deep water outside of the cove in deep water would be utilized. Site No. 26 would serve as the Same Cove helicopter to barge transfer area.

Figure 3-69
LTF Sites for Traitors Cove



	NAME	LTF#	Alternative
**	Margaret Bay	24	2,3,4,5,6
*	North Traitors	22	None
**	North Traitors	23	None
	N.W. Traitors	18	None
*	N.W. Traitors	19	None
*	N.W. Traitors	20	None
*	N.W. Traitors	21	None

○ Investigated Site
● Preferred Site

* Only one LTF needed
** Existing Lease

Traitors Cove

Sites Considered but Eliminated from Detailed Study

Northwest Traitors: Site No. 19 is located in a small bay on the northwest area of Traitors Cove. The site was not considered further because of poor site bathymetric characteristics, small boat anchorage avoidance, and minimization of road development in the state land selection. The site is a non-wetland site. This site does not meet Alaska Timber Task Force guidelines.

Northwest Traitors: Sites No.'s 20 and 21 are located on the northwest part of Traitors Cove. These sites serve the same area as Site No.'s 18 and 19. These sites are not wetlands.

Site No.'s 19, 20, and 21 eliminated because of poor site bathymetric characteristics and proximity to high-value estuarine habitat. These sites do not meet Alaska Timber Task Force guidelines.

North Traitors: Site No. 23 is located about one-half mile east of the salt chuck entrance. The site was eliminated because of proximity to an anadromous fish stream. Site 23 is not a wetland. The site does not meet the Alaska Timber guidelines.

Sites Considered in Detail

NW Traitors: Site No. 18 is located one-fourth mile southeast of the small bay in the northwest Traitors Cove area. This site would require the minimum amount of road within the state land selection.

Site No. 18 has high-value marine habitat. The site was found acceptable for development by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. These agencies have indicated some design constraints to be applied to the final location and construction of this site to minimize impacting the marine habitat in the area. The site is located on a non-wetland site. The site best meets the Alaska Timber Task Force guidelines. It is feasible to connect the tributary area of this site to SW Neets Bay LTF Site No. 17. See Road Connections to Eliminate LTF Sites in the Roads and Facilities section of this chapter.

North Traitors: Site No. 22 is located approximately one mile west of the mouth of the salt chuck. Site No. 22 was considered biologically acceptable by U.S. Fish and Wildlife Service and the National Marine Fisheries Service. These agencies have indicated some design constraints would be applied to the final location and construction of the site to minimize impacting marine habitat in the area. Site No. 22 is located on a non-wetland site. This site best meets the Alaska Timber Task Force guidelines. It is feasible to connect the tributary area of this site to SW Neets Bay LTF Site No. 17. See Road Connections to Eliminate LTF Sites in the Roads and Facilities section of this chapter.

Logging Camps

The North Revilla Project Area has limited suitable upland areas for land camps. Conversely, the area contains numerous protected bays and coves suitable for float camps.

Float Camps

Many historically used float camp sites, and some new sites, are expected to be used in implementation of this project. The number and locations of the sites will depend upon the number of logging and road construction contractors engaged in implementing the project. Additionally, camp configuration and type, such as barge or log floats will influence the location. The operator will be required to obtain required state permits for camps.

Historically used floating logging campsites are shown on Figure 3-70.

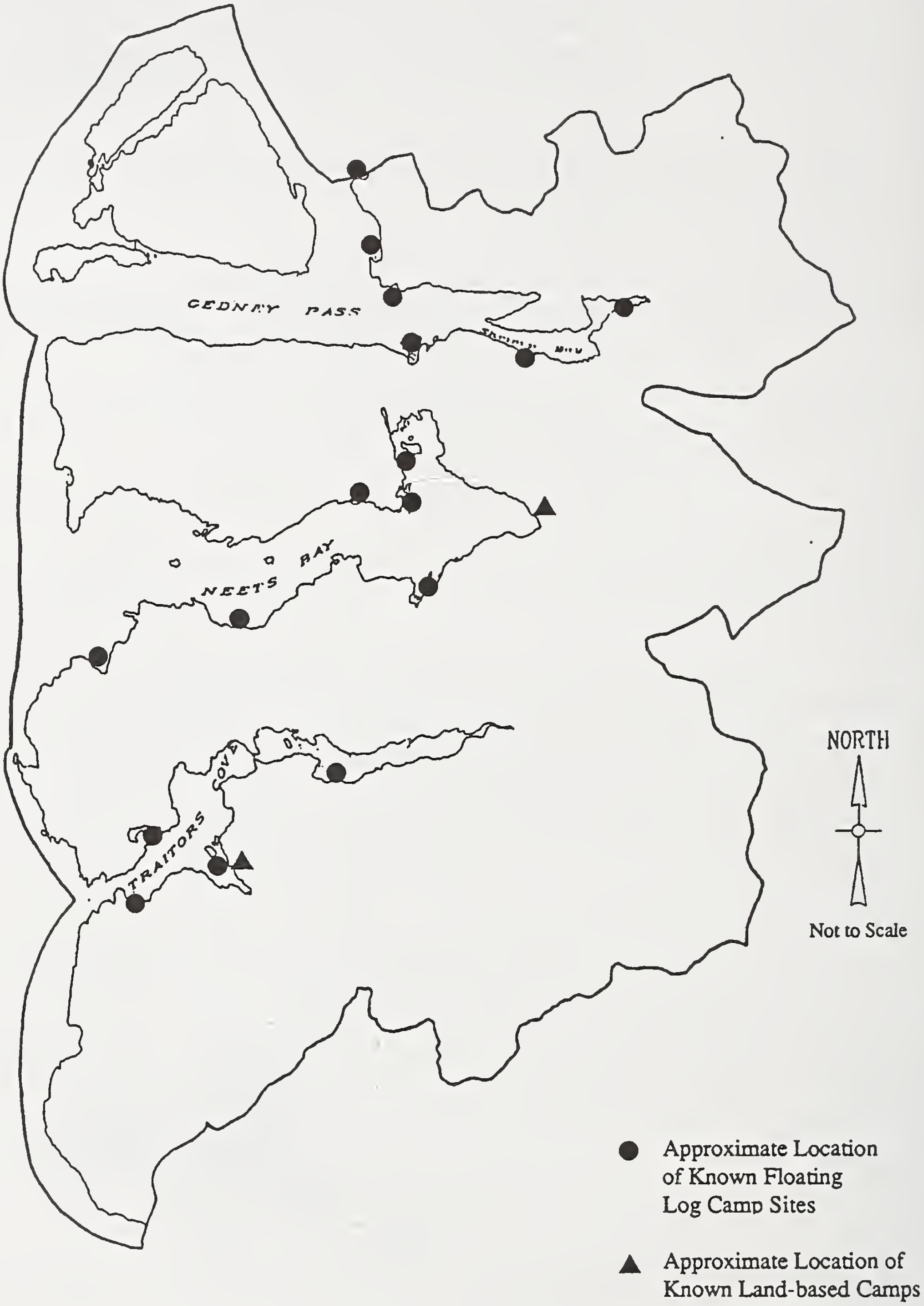
Land Camps

Some previously used land-based camp sites, and potentially some new sites, are expected to be used in implementation of this project. Previously used land camps at Margaret Bay and at the head of Neets Bay could be used again. As with float camps, camp configuration will influence the location.

The contractor/operator will be responsible for obtaining appropriate permits for camps.

Solid waste disposal will not be allowed on national forest land.

Figure 3-70
Historically used Floating logging Camp Sites



Effects of the Alternatives

Log Transfer Facilities

The number of existing and new LTF's required to harvest the timber scheduled in all action alternatives varies. Table 3-190 displays the LTF's required for each alternative.

Table 3-190
LTF's Required for the Alternatives

LTF's Required	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	2140
Existing Sites	0	6	6	5	6	6	7
Proposed Sites	0	1	1	1	1	1	1
Total	0	7	7	7	6	7	8

Effects on Types of LTF's

LTF's can be either low-angle ramps or bulkhead type structures used for transferring logs from trucks to saltwater. Appendix G has a thorough evaluation of proposed LTF's in accordance with the Alaska Timber Task Force guidelines and in accordance with section 404(b)(1) of the Clean Water Act.

Two general types of facilities and their associated effects on the environment are analyzed. The first type of LTF is a low-angle ramp. This facility varies in direct impact to the intertidal area with rock riprap and fill from 0.05 acres to 0.5 acres.

The second type of facility considered in this analysis is a bulkhead facility with a lift-off system. The lift-off system may be either a single or double A-frame. The type of facility ranges in direct impact to the intertidal area with bulkhead construction and fill from 0.1 acres to 0.25 acres.

Of the two designs, the ramp design is approximately one-third the cost to construct, maintain, and operate. Maintenance of a timbered bulkhead facility would require replacement at 10-year intervals, thereby substantially increasing the costs of future harvests (Faris and Vaughan 1985). Concrete bulkheads can be substituted for timbered bulkhead structures, also at a higher cost. Table 3-191 displays the construction and reconstruction costs associated with each LTF.

Another form of log transfer from land to water oriented transportation is aerial transport of logs from the harvest area directly to water or a barge. This method eliminates the need for truck haul and road development. However, this system is economically prohibitive except in specific situations.

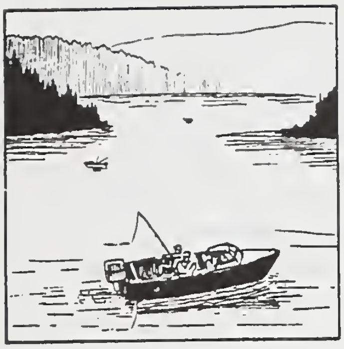
Table 3-191
LTF Construction/Reconstruction Costs

Site	LTF #	Transfer Method	Transfer Equipment Cost	Site Development Cost	Total Cost
Construction:					
Hassler	1	ramp	61,710	102,900	164,610
Chin Point	7	ramp	61,710	102,900	164,610
N. Neets	9	A-frame	250,000	165,200	415,200
Easy	12	A-frame	250,000	261,000	511,000
Easy	13	A-frame	250,000	261,000	511,000
Easy	14	A-frame	250,000	261,000	511,000
NW Traitors Cove	18	ramp	61,710	64,300	126,000
NW Traitors Cove	19	A-frame	250,000	165,200	415,200
NW Traitors Cove	20	A-frame	250,000	261,000	511,000
NW Traitors Cove	21	A-frame	250,000	261,000	511,000
N Traitors Cove	22	A-frame	250,000	133,300	383,300
N Traitors Cove	23	A-frame	250,000	133,300	383,000
Reconstruction:					
Hassler Island	2	A-frame	250,000	115,400	365,400
Klu Bay	4	A-frame	250,000	42,400	292,400
Shrimp Bay	5	A-frame	250,000	42,400	292,400
Chin Point	6	ramp	61,710	60,900	122,610
North Neets	8	A-frame	250,000	165,200	415,200
Clam Island	10	A-frame	250,000	41,600	291,600
Same Cove	11	A-frame	250,000	54,600	304,600
East Neets	15	N/A			
Fire Cove	16	A-frame	250,000	42,400	292,400
SW Neets Bay	17	A-frame	250,000	22,200	272,200
Margaret Bay	24	A-frame	250,000	0	250,000

SOURCE: Rhodes, 1992
* Discrepancies may be found between tables due to rounding

Effects of LTF's on the Marine Benthic Habitat

During the transfer of logs from land to water, bark is sloughed off and may be deposited on the ocean bottom; bark also is continually sloughed off by agitation by wind and waves while the logs are in rafts. If the bark accumulates on the bottom, it can diminish habitat for bottom-dwelling crustaceans and molluscs, as well as hamper underwater vegetation used as food and rearing sites for marine fish and other organisms. All LTF's in the Project Area have been designed to maximize flushing suspended bark away from the LTF area to the open sea before it can accumulate on the bottom. In 1985 it was determined that discharge of bark into the water at an LTF was a discharge requiring a National Pollution Discharge Elimination System (NPDES) permit.



New LTF's are sited in accordance with the Alaska Timber Task Force Siting Guidelines and section 404(B)(1) of the Clean Water Act to mitigate the effects of LTF's on other resources and ecosystems. The existing LTF's that are being reactivated generally meet the above state guidelines.

LTF's will affect the marine benthic habitat (plants and animals that live in and on the bottom). Marine benthic habitat impacts are expected to be as follows:

Structural Embankment: estimated 0.23 acres affected per site
Site Bark Deposition: 1.0 acre zone of deposition per site
Raft Storage Bark Deposition: unknown

The marine benthic environment impacts are displayed in Table 3-192.

Table 3-192
Marine Benthic Impacts by Alternatives

Category	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	2140
Number of Sites							
Existing	0	6	6	5	6	6	7
Proposed	0	1	1	1	1	1	1
Total	0	7	7	6	7	7	8
Acres Effected by Structural Embankment							
Existing	1.4	1.4	1.4	1.2	1.4	1.4	1.6
Proposed	0	0.2	0.2	0.2	0.2	0.2	0.2
Total	1.4	1.6	1.6	1.4	1.6	1.6	1.8
Estimated Acres Effected by Bark							
Existing	0	6.0	6.0	5.0	6.0	6.0	7.0
Proposed	0	1.0	1.0	1.0	1.0	1.0	1.0
Total	0	7.0	7.0	6.0	7.0	7.0	8.0

Structural Embankment All LTF types occupy approximately the same amount of bottom area. For instance, the ramp off-push in a 10 percent grade system extends approximately 250 feet out into the water on a moderately sloped beach. This system is thus long and narrow. The ramp and A-frame systems use more shoreline, and do not protrude out into the water as much as the float off-push in system. All systems, cover about the same bottom area, but in different configurations.

Site Bark Deposition Two publications describe some of the general effects of LTF's and log storage on the marine benthic habitat. Sedell and Duval (1985) summarize the information available on the effects log transport and storage on marine

resources and fisheries. Faris and Vaughn (1985) examined log transportation and log storage in Southeast Alaska.

Shultz and Berg (1976) examined 32 existing LTF's sites and found that 19 had bark accumulation, 8 had no bark accumulation, and 5 had traces of bark. The extent of bark accumulation ranged from 0 to 9.0 acres for 31 of the 32 sites. The 32nd site had accumulation of 182 acres that could not solely be attributed to log transfer activities. Faris and Vaughn (1985) reexamined the original data from Shultz and Berg (1976) and found that the average accumulation size was 1.96 acres for all sites excluding the 182-acre site. They speculate that bark and debris accumulation may be decreasing over time due to currents. No estimate was made on the length of time before bark accumulation was completely eliminated.

Faris and Vaughn (1985) also examined the extent of total damage to the marine benthic habitat in Southeast Alaska. Their results indicate that from the 90 currently permitted sites, a total of 176 acres would be affected (using the 1.96 acre average). This is .02 percent of the total estuarine area that is less than 60 feet deep. Moreover, when they examined all of the potential area of bark and debris accumulation from all permitted and proposed sites in Southeast Alaska, including all sites considered in the KPC Long Term Sale 1989-1994 EIS, they found that a total of 317 acres would be affected. This is 0.09 percent of the total estuarine area that is less than 60 feet deep in all of Southeast Alaska . This result corresponds with the conclusions of Sedell and Duval (1985) that the evidence of damage on important marine populations (bivalves, crabs and salmonids) was inconclusive because of the small area of impact due to log transfer facilities. This evidence resulted in development of the current siting guidelines—e.g., avoiding crab habitat, shallow areas at the heads of bay, etc.—and suggests that impacts would be minimal.

The major effect of bark and debris accumulation is that little neck clams and bay mussels have been shown to be eliminated when as little as 4 to 5 inches of bark accumulates (Freese and O'Clair 1987). Further, Colin and Ellis (1979) reported molluscs and several polychaetes were excluded by bark debris thicker than 2.5 cm., and that effects of bark may last several decades. From this evidence, it can be assumed that other plants and animals that live in and on the bottom would probably be at similar risk.

Concentrations of chemical lechates from bark have been shown to be toxic to salmon fry, crabs, and clams (O'Clair 1983). However, these toxic substances can settle out insalt water; therefore, these substances do not appear to be a major problem in open water where good circulation exists (Sedell and Duval 1985). The Alaska Timber Task Force Siting Guidelines for log transfer facilities (Appendix G) attempts to mitigate the potential effects of bark dispersal and toxicity by: (1) locating LTF's in areas having the least productive inter-tidal and sub-tidal zones, (2) avoiding sensitive habitats, (3) avoiding shallow water, and (4) providing that LTF's should be located along or adjacent to straits,channels, or deep bays where currents are strong enough to disperse sunken or floating wood debris. Currently, all active LTF's receive a yearly underwater diving and sampling transect as required by the Environmental Protection Agency.

Certain dissolved substances (hydrogen sulfide and ammonia) recently have been shown to occur in open spaces between pieces of bark accumulated on the bottom (O'Clair and Freese 1988). O'Clair and Freese also note that it is not clear whether other toxic substances not measured in the study occur within bark accumulations. These substances do not enter the water above the bark. However, if Dungeness crabs

burrow into the bark deposit, it has been demonstrated that their reproductive ability, eating habits, and overall survival can be affected. It should be noted that this type of effect has been demonstrated in only one bark accumulation field (Rowan Bay LTF) and that, in general, Dungeness crabs were not found in bark accumulations at a number of other LTF locations. It is not known whether these effects would occur for other burrowing crab species. Although king crabs do not burrow, it is not clear whether this species is affected by bark and debris accumulation at LTF sites.

Only the Margaret Bay LTF site has been monitored for bark deposition in the project area. Dive records show that the bark has dispersed resulting in no significant bark accumulation at the site. This site has excellent current for dispersing bark deposits to deep water.

Raft Storage Bark Deposition The other potential effects associated with LTF's are from log rafts and log storage in saltwater. The area under a log raft may be affected by bark accumulations with effects similar to but not as concentrated as those discussed for LTF's. In addition, if the raft is stored in a bay or cove for a long period of time, marine algae may be affected by shading. Occasionally, rafts stored in shallow depths may ground on the bottom. This would cause mechanical disruption or compaction of inter- and subtidal bottom habitats. This would be a short-duration effect because recolonization would begin shortly after the raft refloated, unless the site were repeatedly used and log rafts frequently grounded. Proposed and existing log storage areas in the Project Area are deep enough and are not expected to ground.

Barge LTF's Barge LTF's probably would have less effect on the marine environment than rafting LTF's, although no studies are available for comparison. The rock embankment associated with the facility would be longer and slightly wider at the seaward end. The additional length and width would eliminate a larger intertidal area than a rafting LTF breakwater. The longer length and wider seaward end in deeper water would require dredging and filling in the subtidal area Bark and debris would accumulate only in a small area around the extreme seaward end of the facility.

Helicopter to Log Boom or Barge LTF would probably have less effect on the marine environment. Helicopter to log boom would be more impacting than to a barge. However, the log boom can be located in deep water to avoid bark deposition and embankment in the higher value shallow areas. Helicopter to barge would eliminate bark deposition and embankment in the marine environment.

Fisheries

The effects of LTF's on fisheries resources have not been quantified. It is unlikely that any effects on returning adult fish would occur unless a log transfer facility to raft storage areas were immediately adjacent to an anadromous fish stream and caused blockage of entry into the stream. Juvenile pink and chum salmon that spend several months immediately after out-migration in protected bays and coves would be more likely to be affected by activities in the marine environment. These small fish are highly mobile as they actively feed on marine invertebrates. Some of their preferred food items live on the surface of the bottom. Bark accumulation and the area under the embankment of a standard breakwater eliminates a small portion of the habitat of those food items but is unlikely to cause measurable adverse consequences.

It has been hypothesized that the breakwater usually associated with a log transfer facility structure, regardless of whether a raft or barge, can cause greater mortality of pink and chum juveniles because they are forced to move into deeper water where more predators consume them. It is not known whether this is a major source of

mortality in addition to the naturally low survival rate attributed to early marine life stage of juvenile pink and chum salmon. Because barge log transfer facilities require longer breakwaters, the probability of this effect may be increased.

There is no formal documentation that log transfer facility structures or activities associated with their use, conflict with commercial fishing near the facility. If a facility were located in a small bay or cove, it is possible that there could be some difficulty maneuvering around log rafts or moored barges to get to favored fishing sites. No adverse consequences on commercial fishing or subsistence uses or marine resources are anticipated as the result of log transfer facility location.

Camps associated with a log transfer facility site can cause additional use of fisheries and marine sources. There is no data currently available on the amount of additional use occurring at various camp locations in the study area. The competition for resources at or near logging camp locations would probably increase. There is currently little or no information to indicate that resource allocation problems have occurred as the result of a logging camp. The Board of Fisheries and Game can control the amount of harvest by setting bag limits, shortening season lengths, or by instituting a complete closure of a fishery. If resource problems arise because of increased resource pressure due to a logging camp, the Forest Service would aid the Department of Fish and Game in attempting to resolve the problem. However, it is unlikely that all allocation or utilization would progress far enough to cause adverse consequences on the fisheries or marine resource.

Wildlife

From a wildlife perspective, there are two types of effects associated with a log transfer facility and camp. First, there is the potential loss of wildlife habitat due to clearing for the camp, sort yard, and associated facilities. The second possible disturbance to wildlife is a result of increased human activity associated with the camp.

The amount of habitat lost is relatively minor. Whenever possible, camps and sort yard facilities are located away from the highest quality habitat. The differences between a slide facility and barge facility are inconsequential. The objectives are to avoid eagle nest sites and estuarine habitat.

The overall effects of disturbance of wildlife-use patterns are generally minor. Most wildlife species generally adapt to increased human use quickly.

Human activity associated with the camps and facilities may effect wildlife. This includes disturbance of wildlife-use patterns, increased harvest, and increased bear-human encounters.

An increase in the number of people in an area would generally increase the use of and competition for wildlife resources. However, actual harvest levels can be monitored and regulated. The influx of additional people into an area appears to have a greater potential to affect the existing users of the area than wildlife species. Wildlife populations may be affected by the LTF's or logging camps proposed in any of the alternatives. For additional information on the effects of the proposed alternatives on existing users, see the ANILCA, Section 810 Subsistence Evaluation and Finding in the Subsistence section of this chapter.

Visual Resources

The large size, linear bold shape, and saltwater location of log transfer facilities generally dominate the landscape when viewed within a foreground distance. Their relatively low profile, however, helps to mitigate the visual impacts when viewed from a distance. The existing LTF's used in the project share similar components that offer the same visual impacts. Clearings for sort yards and logging camps approximately the same size and located on fairly level or gently sloping sites which helps to absorb much of their visual contrasts when viewed from saltwater. There are no new sort yard areas or camp areas considered in any of the alternatives for this Project Area. It is expected that most camps will consist of floating camps. Accordingly, upland development will consist of maintenance shops and fuel storage system. These facilities will have less impact as they develop less permanent disturbance. For more information, see the Visual Resources section of this chapter.

Long-Term Productivity

This section compares the short-term effects of developing LTF's in the intertidal area to long-term accessibility (for timber management) and productivity in the area. Without a means to transfer logs into salt water, the long-term opportunity to manage the uplands for commercial timber is lost. If LTF's were not approved by permitting agencies, the volume tributary to those facilities would not be available to meet contractual obligation.

It is assumed that other resources would have similar management opportunities with or without access to the uplands from salt water (by an LTF). Table 3-193 compares the number of acres potentially affected by each LTF to the number of acres of suitable timber tributary for each location. It also shows the range of volumes estimated to be transferred at each location for the present and foreseeable future. The range of volumes from the current alternatives and the projections for the foreseeable future, rounded to the nearest MMBF. The last column show the estimated volumes scheduled by the TLMP to meet the allowable sale quantity over the rotation.

Short-term use of 22 acres of estuarine habitat, all of which occurs in large estuaries, would provide access to 21,642 acres of land suitable for timber production. This roughly equates to 260 MMBF to be available to meet commitments to the KPC contract through the year 2004.

Table 3-193
Comparison of Short-term Uses to Long-term Productivity for the Estuarine System

LTF Name	LTF No.	VCU's Served by LTF	Acres Estimated Impact	Rotation Harvest Acres	Potential Harvest Through 2004 MMBF	Potential Harvest Through Rotation 2140 MMBF
Klu Bay	4	732,733	1.2	2,106	27	61
Shrimp Bay	5	733,735 736,737	1.2	3,237	36	99
Dress Point	3	733	1.2	153	0	5
Hassler Island	2	735	1.2	1,847	25	56
Chin Point	7	736	1.2	1,394	16	39
S.W. Neets	17	736,738	1.2	2,405	21	76
Fire Cove	16	736,737 739	1.2	4,842	65	148
Margaret Bay	24	738,739 740	1.2	5,658	70	170

OTHER ENVIRONMENTAL CONSIDERATIONS

Irreversible Commitments

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, unroaded areas, and cultural resources. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed.

The construction of Arterial and Collector roads, to provide access to the Forest, is an irreversible action because of the time it takes for a constructed road to revert to natural conditions. Irreversible actions also include the associated rock quarries which are developed in conjunction with these roads. Alternative 1 will have no new road construction while Alternatives 2, 3, 4, 5, and 6 will construct from 94 to 154 miles of new roads. This will require that up to 80 acres of ground be irreversibly committed to rock quarries and up to 1.5 million cubic yards of rock fill to be placed for road construction and reconstruction.

There are three roadless areas as identified in the TLMP Draft Revision (1991a) that may be affected by the North Revilla project. A decision to develop these roadless areas would mean that their primitive character in terms of opportunities for solitude, remoteness, and development of wilderness skills would irreversibly gone. Figure 3-40 in the Roadless Areas section of this chapter shows the overall size of these roadless areas. Table 3-147 shows the number of roaded and roadless acres by alternative. Alternative 1 schedules no timber harvest in roadless areas; under the range of action alternatives (Alts. 2–6), approximately 7,642–15,464 acres of currently roadless area would be irreversibly committed.

Old-growth habitat lost due to logging can be considered an irreversible effect since it is not expected to regain old-growth characteristics for at least 200 years. From 5,734 to 8,232 acres in the Project Area would change under the range of action alternatives 2–6. See the Biological Diversity section of this chapter.

Loss of soil due to erosion and mass failures is an irreversible commitment. However due to the incorporation of Best Management Practices (BMP's), Forest Plan standards and guidelines, and mitigation measures specified in this document, it is not anticipated that there would be any significant soil loss under any alternative.

Loss of cultural resource sites resulting from accidental damage or vandalism would be an irreversible commitment of resources. The standards and guidelines, survey methodology prior to activities, and mitigation measures specified in this document provide reasonable assurance that there would be no irreversible loss of cultural resources.

Irretrievable Commitments

Irretrievable commitment of natural resources means loss of production or use of resources due to management decisions made in the alternative. This represents opportunities foregone for the period of time that the resource cannot be used.

Foregoing timber harvest opportunities at this time in certain areas due to resource concerns or economics may represent an irretrievable commitment of resources because that volume cannot be harvested. The commitment is irretrievable rather than irreversible, because future technological advances could make harvest of these areas possible and feasible. The Multi-entry Logging Plan (MELP) done for this project identified 11,910 acres of this type in the Project Area.

The reduction in the visual quality of an area due to timber harvesting will be an irretrievable commitment of resources. The commitment is irretrievable since viewsheds will typically heal from a visual quality standpoint after about 40 years. After this time the second-growth trees will have the color and height needed so as not to be evident to the casual observer. Alternative 1 will have no irretrievable commitment of visual quality. Alternatives 2, 3, 4, 5, and 6 will irretrievably commit visual resources due to timber harvesting.

Short-term Uses and Long-Term Productivity

The use of natural resources for long-term sustained yield is at the basis of National Forest management and direction. The proposed timber harvesting under the Best Management Practices (BMP's), Tongass Land Management Plan standards and guidelines, Proposed Alternative P Tongass Land Management Plan Draft Revision (1991a) standards and guidelines, and Regional Guide direction will result in no long-term loss in productivity.

Possible Conflicts with Plans and Policies of Other Jurisdictions

The regulations for implementing NEPA require a determination of possible conflicts between the proposed action and the objectives of Federal, State, and local land-use plans, policies, and controls for the area. The major land-use regulations of concern are the Coastal Zone Management Act (CZMA), Section 810 of ANILCA, and the State of Alaska's Forest Practices Act. A discussion of each of these determinations is presented below.

Coastal Zone Management Act of 1976 (CZMA)

The CZMA was passed by Congress in 1976 and amended in 1990. This law requires Federal agencies conducting activities or undertaking development affecting the coastal zone to ensure that the activities or developments are consistent with approved state coastal management programs to the maximum extent practicable. The State of Alaska passed the Alaska Coastal Management Act in 1977 to establish a program that meets the requirements of the CZMA. It contains the standards and criteria for a determination of consistency for activities within the coastal zone.

Forest Service requirements for consistency are detailed in a Memorandum of Understanding between the State of Alaska and the Regional Forester, dated October 8, 1981. Standards against which the consistency evaluation will take place are: Forest Practices Act, Water, Air, Energy, and Environmental Conservation; and the Alaska Forest Practices Act of 1990.

The Forest Service has designed all alternatives to ensure that the activities and developments affecting the coastal zone are consistent with approved coastal management programs to the maximum extent practicable.

Alaska National Interest Lands Conservation Act of 1980 (ANILCA)

Under Section 810 of ANILCA, agencies are required to evaluate the effects of proposed actions on subsistence uses of Federal land and to determine if the proposed action may significantly restrict subsistence opportunities. Refer to the the Subsistence section of this chapter for the evaluation of impacts to subsistence use as a result of the alternatives.

State of Alaska's Forest Practices Act of 1990

On May 11, 1990, the governor approved the legislature's major revision of the state's Forest Practices Act (FPA). The revised act significantly increases the state's role in providing protection and management for important forest resources on state and private lands. The revised Forest Practices Act will also affect National Forest management through its relationship to the Alaska Coastal Management Program and the Federal CZMA discussed above.

For National Forest timber operations, such as proposed for the North Revilla project, the effect of the revised Forest Practices Act is essentially two-fold. First, it clarifies that the revised Forest Practices Act regulations are the standard which must be used for evaluating timber harvest activities on Federal lands for purposes of determining consistency to the maximum extent practicable with the Alaska Coastal Zone Management Program. Secondly, it calls for minimum 100-foot buffers on all Class I streams, and recognizes that consistency to the maximum extent possible for purposes of the Alaska Coastal Management Program is attainable in Federal timber harvest activities using specific methodologies which may differ from those required by the revised Forest Practices Act or its implementing regulations.

The TTRA prohibited commercial timber harvesting within buffer zones established on all Class I streams and those Class II streams which flow directly into a Class I stream. Buffer zones have a minimum width of 100-feet slope distance from the edge of either side of the stream. In addition, the Forest Service is currently working with the Alaska State Division of Governmental Coordination on a revision of an agreement between the state the Forest Service. This revised agreement will establish the policies and procedures for coordinating state review of Forest Service programs and activities, including those covered by the Forest Practices Act and the Alaska coastal Management Program.

The Forest Service will evaluate the alternatives prior to completion of the Final EIS and the ROD to ensure that the activities and developments specifically covered by the Forest Practices Act are consistent with its provisions to the maximum extent possible.

Energy Requirements and Conservation Potential of Alternatives

The implementation of the proposed actions in the Project Area will require the expenditure of energy (consumption of fuel). The amount of energy used varies by alternative based on timber volume harvested and miles of road constructed or reconstructed. The direct effect of the alternatives on energy requirements would be attributed to timber harvest, road construction and reconstruction, and travel necessary to administer the timber sale. Indirect energy requirements include processing wood products and the transport of the products to secondary processors and consumers.

Fuel Consumption

Fuel consumption requirements were estimated as follows:

- Timber Sale Preparation and Administration — 1.56 gallons/MBF
- Cable Logging — 2 gallons/MBF
- Helicopter Logging — 8 gallons/MBF
- Load, Haul, Dump and Tow — 8 gallons/MBF
- Road Construction — 4,000 gallons/mile
- Road Maintenance — 20 gallons/mile

The estimated total fuel consumption required for each alternative is displayed in Table 3-194.

Table 3-194
Estimated Fuel Consumption (Millions of Gallons)

	Alt.1	Alt.2	Alt.3	Alt.4	Alt.5	Alt.6
Thousands of gallons	0	4,003	2,556	2,937	3,153	3,103
Average gallons/MBF	0	16.0	14.7	16.4	16.2	15.6

SOURCE: Somrak, 1993
Note: The estimated fuel consumption for timber harvest activities is based on consumption per MBF of sawlog volume.

Conservation Potential

In an effort to conserve fuel and/or minimize costs, the Forest Service has undertaken studies nationwide, as well as the Stikine area of the Tongass National Forest, and allowed experimentation with new or different equipment or techniques.

Shovel yarding is estimated to use 2.7 gallons of fuel per MBF, which is almost a gallon more per MBF than for cable yarding. However, savings are realized in employee costs. The cost of Workers Compensation is $18/100MBF for shovel yarding versus $37/100MBF for cable yarding. Crew size and labor cost per MBF is reduced with a crew of 1–2 versus an average of 4 for cable yarding. An example for Alternative 2, based on a fuel cost of $1.50/Gal and the estimates provided in Table 3-103Potential for Shovel Yarding, indicates an approximate savings of $58,000 to the purchaser just in fuel and workman's compensation expence.

The use of low tire pressure equipment (central tire inflation–CTI) during road construction and logging has also shown to decrease costs during studies nationwide and on the Stikine Area of the Tongass National Forest. Studies on Mitkof Island indicate that 10 to 14 percent less rock was needed during road construction, resulting in cost savings of approximately $450,000. It is predicted that costs for rock replacement/road maintenance, log truck fuel, and tire repair and replacement, will be decreased. Cost savings have proven to be substantial enough, that the Forest Service provides a contract clause allowing a reduction in rock replacement deposits when low tire pressure equipment is used.

The use of cable yarding equipment fitted with a mechanical or hydraulic interlocks, provides the ability to decrease yarding expense as the throttle and brake do not have to be ridden simultaneously to provide deflection for the turn of logs.

Natural or Depletable Resource Requirements and Conservation Potential

All alternatives considered in detail are designed to conform to applicable laws and regulations pertaining to natural or depletable resources, including minerals and energy resources. Regulation of mineral and energy activities on the National Forest, under the U.S. Mining Laws Act of 1872 and the Mineral Leasing Act of 1920, is shared with the Bureau of Land Management (BLM). The demand for access to National Forest system lands for the purpose of mineral and energy exploration and development is expected to increase over time.

The action alternatives propose road construction that will increase opportunities for access to the National Forest within the Project Area. This increased access may result in increased activity with regard to both known and potential mineral or energy resource occurrences. There are two mining claims within the Project Area. The actual potential for increased mineral or energy resource activity in the Project Area is not known, nor can an accurate estimate be made.

Urban Quality, Historic and Cultural Resources

The Project Area contains no urban areas. Therefore, the only applicable concern under this topic is with historic and cultural resources. The goal of the Forest Service's Cultural Resource Management Program is to preserve significant cultural resources in their field setting and ensure they remain available in the future for research, social/cultural purposes, recreation, and education. The direct, indirect, and cumulative effects of the alternatives on cultural resources have been evaluated. The result of this evaluation is the determination that there are adequate standards, guidelines, and procedures to protect cultural resources and to meet the goals of the Cultural Resource Management Program. Cultural resources are discussed further in the Cultural section of this chapter.

Consumers, Civil Rights, Minorities and Women

All Forest Service actions have the potential to produce some form of impact, positive and/or negative, on the civil rights of individuals or groups, including minorities and women. The need to conduct an analysis of this potential impact is required by Forest Service Manual and Forest Service Handbook direction. The purpose of the impact analysis is to determine the scope, intensity, duration, and direction of impacts resulting from a proposed action. For environmental or natural resource actions, such as proposed for the Project Area, the civil rights impact analysis is an integral part of the procedures and variables associated with the social impact analysis. This analysis is discussed in the Socio-Economic section of this chapter.

The effect of the alternatives on consumers is reflected in the discussion of the various goods and services supplied as a result of the proposed actions. This analysis occurs throughout the chapter as an integral part of the analysis of the effects on other components of the environment.

Prime Farmland, Rangeland, and Forest Land

All alternatives are in keeping with the intent of Secretary of Agriculture Memorandum 1827 for prime land. The Project Area does not contain any prime farmlands or rangelands. Prime forest land does not apply to lands within the

National Forest system. In all alternatives, lands administered by the Forest Service would be managed with a sensitivity to the effects on adjacent lands.

Threatened and Endangered Species, and Critical Habitat

There will be no adverse impacts to any Federally listed threatened or endangered species or critical habitat as a result of this project. No endangered or threatened wildlife species are known to occur in the Project Area, although Humpback whales and Steller sea lions are occasionally found in waters bordering the Project Area. The discussion of the effects of the alternatives on threatened, endangered, or sensitive species is presented in the Threatened and Endangered Species section of this chapter.

Chapter 4

Literature Cited

List of Preparers

Distribution List

Glossary

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Engineering Technician, Williamette NF, 4 years
Other Relevant Experience
City of Salem Parks and Recreation, 2 years
Bureau of Land Management, 1 year

Gerald Lemke, GIS Technician

Education
A.A., University of Alaska, 1962
Forest Service: 3 years
GIS Technician, (Analyst Assistant), Tongass NF, Ketchikan Area

James Llanos, Systems Analyst

Education
Systems and Procedures, Development and Design, National Career Institute, San Francisco, California, 1967-69.
Forest Service: 2 years
Systems Analyst, Tongass NF, Ketchikan Area, 2 years
Other Relevant Experience
Administrative Officer, Union Bank, 10 years
Research and Development, Federal Home Loan Bank Assn., San Francisco, California, 3 years
Independent Managerial & Systems Consultant, 5 years
Commercial SE Alaska Fisherman, 5 years
Resident Alaskan, 29 years

Norman Matson, Wildlife Biologist

Education
B.S., Game Management, University of Wisconsin-Stevens Point, 1973
Forest Service: 20 years
Planning Biologist, Tongass NF, Ketchikan Area, 1 year
Wildlife Biologist, Tongass NF, Craig RD, 2 years
Timber Sale Administrator/Wildlife Biologist, Chippewa NF, Blackduck RD, 12 years
Recreation/Forestry Technician, Chequamegon NF, Hayward RD, 5 years

Bill Shoaf, Central Prince of Wales Team Leader

Education
B.S., Mathematics, Juniata College, 1970
B.S., Natural Resources Conservation, Univ. of Connecticut, 1977
M.S., Natural Resources Conservation, Univ. of Connecticut, 1978
Forest Service: 15 years
IDT Leader/Forester, Tongass NF, Ketchikan Area, 2 years
Systems Analyst/Forester, Washington Office, 3 years
Presale Forester, Siuslaw NF, 6 years
Timber Sale Officer, Boise NF, 3 years
Forestry Technician, Clearwater NF, 1 year
Other Relevant Experience
Systems Analyst, Hartford, Connecticut, 5 years
Timber Faller, Coventry, Connecticut, 2 years
Logging contractor, Mapleton, Oregon, 1 year
Commercial crabber, Florence, Oregon, 2 years
Commercial crabber, Chesapeake Bay, 2 years

4 List of Preparers

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Education
B.S., Natural Resources, Kent State University, 1974
B.S., Forestry, University of Michigan, 1976
Forest Service: 11 years
Planning Forester, Tongass NF, Ketchikan Area, 1 year
Recreation, Lands, & Minerals Forester, Tongass NF, Stikine Area, Wrangell RD, 2 years
Pre-sale Forester, Tongass NF, Stikine Area, Wrangell RD, 3 years
Pre-sale Forester, Tongass NF, Chatham Area, Juneau RD, 1 year
Pre-sale Forester, Tongass NF, Chatham Area, Supervisor's Office, 2 years
Recreation Forestry Technician, Chugach NF, Cordova RD, 2 years
Other Relevant Experience
Director of Natural Resource Dept., Eyak Native Corporation, 2 years
Natural Resources Officer, Alaska Department of Natural Resources, Div. of Land & Water Mgt., 2 years
Lead Inventory Forester, Bureau of Indian Affairs, 1 year

Ralph E. Spear, GIS Analyst

Education
Uniformed Armed Services Institute, 2 years
Forest Service: 5 years
GIS Analyst, Tongass NF, Ketchikan Area SO, 6 months
GIS Supervisor/Programmer, Tongass NF, Ketchikan Area SO, 3.5 years
GIS Technician, Tongass NF, Ketchikan Area SO, 1 year
Other Relevant Experience
Resident Alaskan, 17 years

Paul Zellmer, Fisheries Biologist

Education
B.S., Fisheries, Humboldt State University, 1968
Graduate courses in Biological Oceanography, Humboldt State University
Forest Service: 9 years
San Dimas Technology Development Center
Other Relevant Experience
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Aqua Tech Consultants, 2 years
Aqua Media, Inc., 2 years

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M.A., Anthropology, University of Northern Colorado, 1973
Forest Service: 10 years
Area Archeologist, Tongass NF, Ketchikan Area, 5 years
Assistant Forest Archaeologist, Kaibab National Forest, 3 years
Archaeological Technician, Tongass NF, Chatham Area, 2 years

Tom DeMeo, Ecologist

Education
B.S., Forest Science, Pennsylvania State University, 1980
M.S., Forest Science, Oregon State University, 1987
Forest Service: 5 years
Ecologist, Tongass NF, Ketchikan Area, 5 years

Marlene Finley, Natural Resource Planner

Education
M.S., Forest Resource Management, Oregon State Univ., 1990
B.S., Environmental Planning and Management, Univ. of California, Davis, 1982
Forest Service: 6 years
Natural Resource Planner, Suislaw NF, 3 years
Forestry Tech, Suislaw NF, 3 years
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National Park Ranger, Cumberland Island National Seashore, 6 years

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B.S., Cartography, George Washington University, 1972
Diploma, DMA School of Cartography, 1949
Diploma, DMA School of Photogrammetry, 1948
Forest Service: 14 years
Cartographer, Alaska Region, Regional Office, 14 years
Other Relevant Experience
Cartographer, Department of Defense, 27 years
Cartographer, Bureau of Land Mgt., Alaska, 2 years

Don Ranne, Lands Forester

Forest Service: 22 years
Lands Forester, Tongass NF, Ketchikan Area, 9 years
District Staff Officer, Prescott NF, Chino Valley RD, 8 years
Timber Forester, Apache-Sitgreaves NF, Alpine RD, 1 year
Forestry Technician, Coconino NF, Elden RD, 4 years

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Carol Seitz-Warmuth, Geotechnical Engineer

Education
B.S., Geotechnical Engineering, Michigan Technical University, 1982
Graduate studies, Geophysics, University of Arizona 1983-84
Forest Service: 8 years
Fisheries Engineer, Tongass NF, Ketchikan Area, 1 year
Geotechnical Engineer, Tongass NF, Ketchikan Area 4 1/2 years
Transportation Planner, Tongass NF, Chatham Area 1/2 year
Geotechnical Engineer, Tongass NF, Chatham Area 2 1/4 years

John Short, Landscape Architect

Education
B.S., Journalism, Cornell University, 1967
MLA, Landscape Architecture, Cornell University, 1975
Forest Service: 15 years
Forest Landscape Architect, Ketchikan Area, 15 years
Other Relevant Experience
Landscape architect, City Planning Dept. N.Y. 1 year
Self-employed, Landscape Architect, 3 years

Allison Young, Archaeologist

Education
B.A., Anthropology University of Alaska-Fairbanks, 1986
M.A., Museum Studies, Texas Tech. University, 1989
Ph.D. Candidate, Anthropology, University of British Columbia.
Forest Service: 1 year
Archaeologist, Tongass NF, Ketchikan Area

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USDI Fish & Wildlife Service, Walter Stieglitz, Reg. Dir; Anchorage
USDI Fish & Wildlife Service, Ketchikan
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Utah State University, Carla Heister; Logan, UT
Valley Park Elementary School; Ketchikan
Whale Pass School
Wrangell Public Library, Irene Ingle
Wrangell Resource Council, Marlene Clarke
Wrangell Sentinel, Lew Bresee, Editor
Wrangell Subsistence Advisory Com., Edward P. Churchill, Sr.

List of Agencies, Organizations, and Persons to Whom Summary Copies of the Final Environmental Impact Statement Were Sent

Individuals Sent Summary of Final EIS

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Agencies and Organizations Sent Summary of Final EIS

Alaska Office of the Governor
Juneau Empire
Saxman Advisory Committee, Tom Abbott
Associated Press, Brian Akre
Petersburg Chamber of Commerce, Kimberley Aulbach
Wrangell Resource Council, Peter Branson
Southeast Exposure, Betsey Burdett
Pacific Legal Foundation, James Burling
Alaska Timberland Corp, Glen Charles, General Mgr.
Ketchikan Daily News, Belinda Chase
Chenhall Surveying, Don Chenhall
Alaska Lumberman's Assn. - KPC, C.L. Cloudy
Service Auto Parts, Inc., J.C. Conley
Alaska Dept. of Fish & Game, Don Cornelius, Habitat Bio
Cowan Towing Co., Robert Cowan
Alaska Representative, Representative Cherie Davis
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Alaska Women in Timber, Jackie Durette, Director
Durette Construction Co. Inc., Robert R. Durette Sr.
Island News, Editor
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Pacific Service Company, Carl Elliot
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Alaska Dept. of Commerce, Paul Fuhs, Director
Eagle Timber, Inc.. John P. (Jack) Gabriel, Op. Mgr.
Atlas Alaska, Inc., Ronald Gelbrich
Kruse Tractor, John Griffin
Alaska Power & Telephone Co., Robert Grimm
Southeast Exposure, Geoffrey Gross
Yes Bay / Mink Bay Lodges, Kevin Hack

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FHWA/WFLHD, Jody Thomas
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Koncor Forest Products, Joseph Wehrman III
B & D Lab, Dave & Bonna Wieler
University of AK Board of Regents, Lew Williams Jr.
Cape Fox Corporation, William K. Williams, President
AK Dept. of Environmental Conserv., Ira Winogard, Wetlands Coord.
Six Robblees' INC., Tom Winter
Production Sonobuoys & Fleet Lisi., Cdr. Robert Wood Jr., Dept. Navy
Biowest, Gordon Yonker

Glossary

Access
The opportunity to approach, enter, and make use of public lands.

Access Management
Acquiring rights and developing and maintaining facilities needed by people to get to and move through public lands (physical attributes).

Active Channel
Unstable portion of a stream where stream channels are frequently changing course.

Adfluvial Fish
Species of populations of fish that do not go to sea, but live in lakes, and enter streams to spawn.

Aelvin
Young salmon that are still attached to the yolk sac, which provides nourishment.

Aerial Harvest Systems
Harvesting methods in which the cut logs are moved from the stump to the loading area or log deck without touching the ground, for example helicopter logging.

Aggradation
The process of building up a land surface by deposition.

Alaska National Interest Lands Conservation Act (ANILCA)
Passed by Congress in 1980, this legislation designated 14 National Forest wilderness areas in Southeast Alaska. The Alaska National Interest Lands Conservation Act of December 2, 1980. Public Law 96-487, 96th Congress, 94 Stat. 2371-2551. In Section 810 requires evaluations of subsistence impacts before changing the use of these lands.

Alaska Native Claims Settlement Act (ANCSA)
Public Law 92-203, 92nd Congress, 85 Stat. 2371-2551. Approved December 18, 1971, ANCSA provides for the settlement of certain land claims of Alaska natives and for other purposes.

Allowable Sale Quantity (ASQ)
ASQ refers to the maximum quantity of timber that may be sold each decade from the Tongass National Forest. This quantity, expressed as a board foot measure, is calculated per timber utilization standards specified in the Alaska Regional Guide, the number and type of acres available for timber management, and the intensity of timber management. The ASQ was calculated at 4.5 billion board feet per decade for the Tongass National Forest.

Alluvial Fan
A cone-shaped deposit of organic and mineral material made by a stream where it runs out onto a level plain or meets a slower stream.

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Alluvium
Material deposited by rivers or streams, including the sediment laid down in river beds, flood plains and at the foot of mountain slopes and estuaries.

Alpine
Parts of mountains above tree growth and/or the organisms living there.

Alternative
One of several policies, plans, or projects proposed for decision making.

Anadromous Fish
Anadromous fish (such as salmon, steelhead, and sea run cutthroat trout) spend part of their lives in freshwater and part of their lives in saltwater.

Anadromous Species
One whose individuals are born in freshwater but migrate to and feed in the sea before returning to freshwater to breed.

Aquatic Habitat Management Unit (AHMU)
A mapping unit that displays an identified value for aquatic resources. It is a mechanism for carrying out aquatic resource management policy.
Class I AHMU: Streams with anadromous or high-quality sport fish habitat. Also included is the habitat upstream from migration barrier known to have reasonable enhancement opportunities for anadromous fish.
Class II AHMU: Streams with resident fish populations and generally steep (6 to 15 percent) gradient (can also include streams from 0 to 6 percent gradient where no anadromous fish occur). These populations have limited sport fisheries values and are separate from the high-quality sport fishing systems included in Class I. They generally occur upstream of migration barriers or are steep gradient streams with other habitat features that preclude anadromous fish use.
Class III AHMU: Streams with no fish populations but have potential water quality influence on the downstream aquatic habitat.

Background
The distant part of a landscape. The seen, or viewed, area located from three or five miles to infinity from the viewer. (See "Foreground" and "Middleground".)

Beach Fringe Use Area
Non-forested wildlife use areas that occur from the intertidal zone inland 500 feet and islands of less than 50 acres. Forested wildlife use areas that occur from the intertidal zone island 600 feet and islands of less than 50 acres.

Bedload
Sand, silt, and gravel, or soil and rock debris rolled along the bottom of a stream by the moving water.

Benthic
Refers to the substrate and organisms in and on the bottom of a body of water.

Best Management Practice (BMP)
Practices used for the protection of water quality. BMP's are designed to prevent or reduce the amount of pollution from nonpoint sources or other adverse water quality impacts while meeting other goals and objectives. BMP's are standards to be achieved, not detailed or site specific prescriptions or solutions. BMP's as defined in

the USDA Forest Service Soil & Water Conservation Handbook are mandated for use in Region 10 under the Tongass Timber Reform Act.

Biological Diversity (Biodiversity)
The variety of life in all its forms and at all levels. This includes the various kinds and combinations of: genes; species of plants, animals, and microorganisms; populations; communities; and ecosystems. It also includes the physical and ecological processes that allow all levels to interact and survive. The most familiar level of biological diversity is the species level, which is the number and abundance of plants, animals, and microorganisms.

Biological Potential
The maximum possible output of a given resource limited only by its inherent physical and biological characteristics.

Biomass
The total quantity, at a given time, of living organisms of one or more species per unit area or all of the species in a community.

Biotic
Refers to life, living. See also, abiotic.

Blowdown
See windthrow.

Board Foot (BF)
A unit of wood 12" X 12" X 1". One acre of commercial timber in Southeast Alaska on the average yields 28,000-34,000 board feet per acre (ranging from 8,000-90,000 board feet per acre). One million board feet (MMBF) would be the volume of wood covering one acre two feet thick. One million board feet yields approximately enough timber to build 120 houses or 75,555 pounds of dissolving pulp.

Bole
Trunk of the tree.

Braided Streams or Channels
A stream flowing in several dividing and reuniting channels resembling the strands of a braid, the cause of division being the obstruction by sediment deposited by the stream.

Broadcast Burning
Burning of an area that has been clearcut to remove logging slash from the site. Broadcast burning is done to prepare sites for regeneration or improve wildlife habitat.

Brush Disposal
Cleanup and disposal of slash and other hazardous fuels within the forest or project areas.

Buffer
Tongass Timber Reform Act (TTRA) requires that timber harvest be prohibited in an area no less than 100 feet on each side of all Class I streams and Class II streams which flow directly into Class I streams. This 100-foot area is known as a buffer.

Cant

A log partly or wholly cut and destined for further processing.

Capability
An evaluation of a resource's inherent potential for use.

Carryover
Timber volume designated for harvest in a five-year operating period but not harvested during that period. It is available, therefore, for subsequent five-year operating periods.

Channel Migration
Movement of a stream or river channel within a floodplain area usually over an extended period of time.

Clearcut
The harvesting in one cut of all trees on an area. The area harvested may be a patch, strip, or stand large enough to be mapped or recorded as a separate class in planning for sustained yield. Clearcut size on the Tongass National Forest is limited to 100 acres, except for specific conditions noted in the Alaska Regional Guide.

Climax
A community of plants and animals which is relatively stable over time and which represents the late stages of succession under current climate and soil conditions.

Code of Federal Regulations (CFR)
A codification of the general and permanent rules published in the Federal Register by the executive departments and agencies of the Federal Government.

Commercial Forest Land (CFL)
Productive Forest land that is producing or capable of producing crops of industrial wood and is not withdrawn from timber utilization by statute or administrative regulation. This includes areas suitable for management and generally capable of producing in excess of 20 cubic feet per acre of annual growth or in excess of 8,000 board feet net volume per acre. It includes accessible and inaccessible areas.
Normal CFL: Timber that can be economically harvested with locally available logging systems. Composed of two categories:
Standard: Timber that can be economically harvested with locally available logging systems, such as highlead or short-span skyline.
Special: Timber that is in areas where special consideration is needed to protect other resources but can be harvested with locally available logging systems.
Non-standard CFL: Timber that cannot be harvested with locally available logging systems and would require the use of other logging systems such as helicopter or long-span skyline.

Commercial Thinning
Thinning a stand where the trees to be removed are large enough to sell.

Confluence
The point where two streams meet.

Corridor
Connective links of certain types of vegetation between patches of suitable habitat which are necessary for certain species to facilitate movement of individuals between patches of suitable habitat. Also refers to transportation or utility rights-of-way.

Cover
Refers to trees, shrubs, or other landscape features that allow an animal to partly or fully conceal itself.

Critical Habitat
Specific terrain within the geographical area occupied by threatened or endangered species. Physical and biological features that are essential to conservation of the species and which may require special management considerations or protection are found in these areas.

Crown
The tree canopy. The upper part of a tree or woody plant that carries the main branch system and foliage.

Cruise
Refers to the general activity of determining timber volumes and quality as opposed to a specific method.

Cull Logs
Trees that do not meet certain quality specifications.

Culmination Mean Annual Increment (CMAI)
The point at which a tree (or stand) achieves its highest average growth, based on expected growth according to the management intensities and utilization standards assumed in the Forest Plan.

Cultural Resources
Historic or prehistoric objects, sites, buildings, structures, and their remains, resulting from past human activities.

Cumulative Effects
The impacts on the environment resulting from additional incremental impacts of past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions occurring over time.

Cutover
Areas harvested recently.

DBH (DBH)
Diameter Breast Height. The diameter of a tree measured 4 feet 6 inches from the ground.

Debris Avalanche
The sudden movement downslope of the soil mantle; it occurs on steep slopes and is caused by the complete saturation of the soild from prolonged heavy rains. Also known as a debris slide.

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Debris Flow
A general term for all types of rapid movement of debris downslope.

Debris Torrents
Landslides that occur as a result of debris; avalanche materials which either dam a channel temporarilty or accumulate behind temporary obstructions such as logs and forest debris.

Deer Winter Range
Locations that provide food and shelter for Sitka Black-tail deer under moderately severe to severe winter conditions.

Degradation
The general lowering of the surface of the land by erosive processes, especially by the removal of material through erosion and transportation by flowing water.

Demographic
Pertaining to the study of the characteristics of human populations, such as size, growth, density, distribution, and vital statistics.

Detritis
Material, produced by the disintegration and weathering of rocks, that has been moved from its site of origin.

Developed Recreation
Recreation that requires facilities that, in turn, result in concentrated use of an area. Facilities in these areas might include roads, parking lots, picnic tables, toilets, drinking water, and buildings.

Direct Employment
The jobs that are immediately associated with the Long-Term Contract Timber Sale, including, for example, logging, sawmills, and pulpmills.

Discount Rate
The rate used to adjust future benefits or costs to their present value.

Dispersion
To disperse the effects of timber harvest by distributing harvest units more or less uniformly throughout a drainage so that increased runoff and sediment from disturbed sites will be buffered by lower levels of runoff and sediment production from surrounding undisturbed lands.

Dissected Landforms
A physical, recognizable form or feature of the earth's surface such as a mountain, hill, or valley having a characteristic shape, that in part is the result of several shallow or deeply incised drainage channels.

Dissolved Oxygen
The amount of free (not chemically combined) oxygen in water.

Distance Zone
Areas of landscapes denoted by specified distances from the observer (foreground, middleground or background). Used as a frame of reference in which to discuss landscape characteristics of management activities.

Diversity
The distribution and abundance of different plant and animal communities and species within the area controlled by the Forest Plan.

Draft Environmental Impact Statement (DEIS)
A statment of environmental effects for a major Federal action which is released to the public and other agencies for comment and review prior to a final management decision. Required by Section 102 of the National Environmental Policy Act (NEPA).

Eagle Nest Tree Buffer Zone
A 330-foot radius around eagle nest trees established in an Agreement between the U.S. Fish and Wildlife Service and the Forest Service.

Ecosystem
A community of organisms and its physical setting. An ecosystem, whether a fallen log or an entire watershed, includes resident organisms, non-living components such as soil nutrients, inputs such as rainfall, and outputs such as organisms that disperse to other ecosystems.

Ecotone
A transition or junction zone between two or more naturally occurring diverse plant communities (ecosystems).

Ecotype
A species of plant or animal that displays different genetic or physiological adaptations. For example, the brown bear in Southeast Alaska is the same species as the grizzly bear in interior Alaska, but the brown bear is generally larger than the grizzly.

Effects
Effects, impacts, and consequences as used in this environmental impact statement are synonymous. Effects may be ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, or social, and may be direct, indirect, or cumulative.
Direct Effects: Results of an action occurring when and where the action takes place.
Indirect Effects: Results of an action occurring at a location other than where the action takes place and/or later in time, but in the reasonably forseeable future.
Cumulative Effects: See Cumulative Effects.

Encumbrance
A claim, lien, charge, or liability attached to and binding real property.

Endangered Species
Any species of animal or plant that is in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act. See also, threatened species, sensitive species.

Environmental Analysis (EA)
A comprehensive evaluation of alternative actions and their predictable short-term and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions. An EA is less comprehensive than an Environmental Impact Statement (EIS), and may result in a Finding of No

Significant Impact; should the EA reveal significant impacts, a full EIS must then be conducted.

Erosion
The wearing away of the land surface by running water, wind, ice, gravity or other geological activities.

Escapement
Adult anadromous fish that escape from all causes of mortality (natural or human-caused) to return to streams to spawn.

Estuarine Fringe Use Area
A 1,000-foot timbered zone around an estuary.

Estuary
For the purpose of this EIS process, estuary refers to the relatively flat, intertidal, and upland areas generally found at the heads of bays and mouths of streams. They are predominately mud and grass flats and are unforested except for scattered spruce or cottonwood.

Even-Aged Management
The application of a combination of actions that result in the creation of stands in which trees of essentially the same age grow together. The difference in age between trees in forming the main canopy level of a stand usually does not exceed 20 percent of that age of the stand at harvest rotation age. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Executive Order
An order or regulation issued by the President or some administrative authority under his or her direction.

Existing Visual Condition
The level of visual quality or condition presently occurring on the ground. The six existing visual condition categories are:
Type I: Natural Condition. Areas in which only ecological change has taken place. Corresponds to the Preservation VQO.
Type II: Natural appearing. Areas in which changes in the landscape are not noticed by the average forest visitor unless pointed out. Corresponds to the Retention VQO.
Type III: Slightly altered. Areas in which changes in the landscape are noticed, but do not attract attention. Corresponds to the Partial Retention VQO.
Type IV: Moderately altered. Areas in which changes in the landscape are easily noticed and may attract attention. Corresponds to the Modification VQO.
Type V: Heavily altered. Areas in which changes in the landscape obviouly appear to be major disturbances and stand out as a dominating impression of the landscape. Corresponds to the Maximum Modification VQO.
Type VI: Drastically altered. Areas in which changes in the landscape are in glaring contrast to a natural appearance. Not a VQO.

Final Environmental Impact Statement (FEIS)
The final version of the statement of environmental effects required for major federal actions under Section 102 of the National Environmental Policy Act. It is a revision of the draft environmental impact statement (DEIS) to include public and agency responses to the draft. The decision maker chooses which alternative to select from the Final EIS, and subsequently issues a Record of Decision (ROD).

Fiscal Year (FY)
October 1 through September 30, e.g. October 1, 1992 - September 30, 1993 = FY93.

Floodplain
That portion of a river valley, adjacent to the river channel, which is covered with water when the river overflows its banks at flood stages.

Fluvial
Of or pertaining to streams and rivers.

Foreground
The stand of trees immediately adjacent to a scenic area, recreation facility, or forest highway; area located less than 1/4 mile from the viewer. See also, Background and Middleground.

Forest and Rangeland Renewable Resources Planning Act of 1976 (RPA)
Amended in 1976 by the National Forest Management Act. See RPA Assessment and Program.

Forest or Forest Land
National Forest lands currently supporting or capable of supporting forests at a density of 10 percent crown closure or better. Includes all areas with forest cover, including old growth and second growth, and both commercial and non-commercial forest land.

Forested Wetland
A wetland whose vegetation is characterized by an overstory of trees that are 20 feet or taller.

FORPLAN
The forest planning model. A linear programming software package used to analyze planning decisions regarding land use patterns, capital investment, and timber harvest scheduling.

FSH
Forest Service Handbook.

FSM
Forest Service Manual.

Geographic Information System (GIS)
An information processing technology to input, store, manipulate, analyze, and display spatial and attribute data to support the decision-making process. It is a system of computer maps with corresponding site specific information that can be electronically combined to provide reports and maps.

Geomorphology
The study of the forms of the land surface and the processes producing them. Also the study of the underlying rocks or parent materials and the landforms present which were formed in geological time.

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Glide or Placid Streams
Grouping of channel types (L1 and L2) that have fairly consistent physical characteristics occurring on lowland landforms and are mostly associated with bogs, marshes, or lakes.

Groundwater
Water within the earth that supplies wells and springs.

Guideline
A preferred or advisable course of action or level of attainment designed to promote achievement of goals and objectives.

Habitat
The sum total of environmental conditions of a specific place occupied by an organism, population, or community of plants and animals.

Habitat Capability
The number of healthy animals that a habitat can sustain. Used in wildlife models to calculate rough population estimates for Management Indicator Species.

Habitat Improvement
Management of wildlife and fish habitat to increase their capability.

Hard Snags/Soft Snags
Hard snags are dead trees which have little decay and are generally still hard wood. Soft snags are dead trees which have a considerable amount of decay and are generally soft, broken wood.

Haul out
An area of large, smooth rocks used by seals and sea lions for resting and pupping.

Humus
Substance of organic origin that is fairly but not entirely resistant to further bacterial decay.

Hydrophyte
Plants typically found in wet habitats.

IMPLAN
A computer-based system used by the Forest Service for constructing nonsurvey input/output models to measure economic input. The system includes a data base for all counties in the United States and a set of computer programs to retrieve data and perform the computational tasks for input/output analysis.

Indirect Employment
The jobs in service industries that are associated with the Long-Term Contract timber sale including for example suppliers of logging and milling equipment.

Inoperable Timber
Timber that cannot be harvested by any proven method because of potential resource damage, extremely adverse economic considerations, or physical limitations.

Interdisciplinary Team (IDT)
A group of people with different backgrounds assembled to research, analyze, and write a project Environmental Impact Statement. The team is assembled out of recognition that no one scientific discipline is sufficiently broad enough to adequately analyze a proposed action and its alternatives.

Invertebrates
Animals without a backbone.

Irretrievable Commitments
Losses of production or use of renewable natural resources for a period of time. For example, timber production from an area is irretrievably lost during the time an area is allocated to a no-harvest prescription; if the allocation is changed to allow timber harvest, timber production can be resumed. The production lost is irretrievable, but is not irreversible.

Irreversible Commitments
Decisions causing changes which cannot be reversed. For example, if a roadless area is allocated to allow timber harvest and timber is actually harvested, that area cannot, at a later date, be allocated to wilderness. Once harvested, the ability of that area to meet wilderness criteria has been irreversibly lost. Often applies to nonrenewable resources such as minerals and cultural resources.

Issue
A point, matter, or section of public discussion or interest to be addressed or decided.

Knutsen-Vandenburg Fund (KV)
The portion of timber sale receipts collected and used for reforestation and other renewable resource projects on the sale area.

Land Allocation
The decision to use land for various resource management objectives to best satisfy the issues, concerns and opportunities and meet assigned forest output targets.

Land Exchange
The conveyance of non-Federal land or interests to the United States in exchange for National Forest System land or interests in land.

Land Use Designation (LUD)
The method of classifying land uses presented in the Tongass Land Management Plan (TLMP). Land uses and activities are grouped to define, along with a set of coordinating policies, a compatible combination of management activities. The following is a description of the four classifications:
LUD I: Wilderness areas. Undeveloped areas managed for solitude and primitive types of recreation, and containing unaltered habitats for plant and animal species.
LUD II: Lands to be managed in a roadless state in order to retain their wildland character; permits wildlife and fish habitat improvement as well as primitive recreation facility and road development under special authorization.
LUD III: Lands to be managed for a variety of uses. The emphasis is on managing for uses and activities in a compatible and complimentary manner to provide the greatest combination of benefits.
LUD IV: Lands that provide opportunities for intensive resource use and development where the emphasis is primarily on commodity or market resources.

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Land Use Prescriptions
Specific management direction applied to a defined area of land to attain multiple use and other goals and objectives.

Landslides
The moderately rapid to rapid down slope movement of soil and rock materials that may or may not be water-saturated.

Large Woody Debris (LWD)
Any large piece of relatively stable woody material having a diameter of at least four inches and a length greater than three feet that intrudes into the stream channel. Also called Large Organic Debris (LOD).

Log Transfer Facility (LTF)
A facility that is used for transferring commercially harvested logs to and from a vessel or log raft, or the formation of a log raft. It is wholly or partially constructed in waters of the United States and location and construction are regulated by the 1987 Amendments to the Clean Water Act. Formerly termed "terminal transfer facility" or "log dump".

Logging Systems
Highlead: A cable yarding system, using a two-drum yarder, in which lead blocks are are hung on a spar or tower to provide lift to the front end of the logs. Grabinski is a modified highlead cable system.
Aerial Logging Systems: Systems where the cut logs are moved from the stump to the loading area or log deck without touching the ground.
Live skyline/gravity carriage return: A two-drum, live skyline yarding system in which the carriage moves down the skyline by gravity; thus, is restricted to uphill yarding; the skyline is lowered to attach logs then raised and pulled to the landing by the mainline.
Live skyline/haulback required: A live skyline yarding system composed of skyline, mainline, and haulback; the carriage is pulled to the woods by the haulback; the skyline is lowered to permit the chockers to be attached to the carriage, and the turn is brought to the landing by the mainline.
Running skyline: A yarding system with three suspended moving lines, generally referred to as the main, haulback, and slack-pulling, that when properly tensioned will provide lift, travel and control to the carriage; normally indicates a gantry type tower and a three-drum yarder.
Standing skyline: Used wherever yarding distances or span distances exceed the capability of live skyline equipment.
Multispan skyline: European equipment is commonly associated with this.
Tractor: Used to describe the full range of surface skidding equipment, designed to operate on level to downhill settings.
Shovel: A system of short-distance logging in which logs are moved from the stump to the landing by repeated swinging with a swing-boom log loader; the loader is walked off the haul road and out into the harvest unit; logs are moved and decked progressively closer to the haul road with each pass of the loader; when logs are finally decked at roadside, the same loader, or a different loader, loads out trucks. On gentle ground, logs are either heeled and swung or dragged by the boom as it rotates; larger log length and tree length logs are usually dragged to maintain machine stability. Soils should be moderate to well drained and side slopes must be less than 20 percent; passes or stripes should be kept to a maximum of four.

Helicopter: Flight path cannot exceed 40 percent downhill or 30 percent uphill; landings must be selected so there is adequate room for the operation and so that the helicopter can make an upwind approach to the drop zone.
A-Frame: Beach fringe timber which is logged with a float mounted yarder typically rigged in a highlead configuration for direct A-frame yarding.
Cold-deck and swing: Planned to access areas not suitable for skyline operations.

MBF
A thousand board feet net sawlog and utility volume.

MMBF
A million board feet net sawlog and utility volume.

MMCF
A million cubic feet net sawlog and utility volume.

Management Area
An area one or more VCU's in size for which management direction was written in the Tongass Land Management Plan.

Management Indicator Species (MIS)
Species selected in a planning process that are used to monitor the effects of planned management activities on viable populations of wildlife and fish, including those that are socially or economically important.

Management Prescriptions
Method of classifying land uses presented in the Tongass Land Management Plan (TLMP) Revision DEIS. Replaces the Land Use Designations (LUD's) originally presented in TLMP.

Management Requirement
Standards for resource protection, vegetation manipulation, silvicultural practices, even-aged management, riparian areas, soil and water and diversity, to be met in accomplishing National Forest System goals and objectives. (see 36 CFR 219.17)

Mass Failure
The downslope movement of a block or mass of soil. This usually occurs under conditions of high-soil moisture and does not include individual soil particles displaced as surface erosion.

Maritime Climate
Weather conditions controlled by an oceanic environment characterized by small annual temperature ranges and high precipitation.

McGilvery (Soil series)
Soil series which represents the only well-drained organic soil found in the Ketchikan Area. It is composed of a thin surface layer (less than 8 inches deep) of organic material overlying bedrock. These soils are associated with cliffs and rock outcrops, and are sensitive to disturbance.

Mean Annual Increment (MAI)
The total volume of a stand divided by its age.

Memorandum of Understanding (MOU)
A legal agreement between the Forest Service and others agencies resulting from consultation between agencies that states specific measures the agencies will follow to accomplish a large or complex project. A memorandum of understanding is not a fund obligating document.

Microclimate
The temperature, moisture, wind, pressure, and evaporation (climate) of a very small area that differs from the general climate of the larger surrounding area.

Middleground
The visible terrain beyond the foreground where individual trees are still visible but do not stand out distinctly for the landscape; area located from 1/4 to 5 miles from the viewer. See also, Foreground and Background.

Mineral Soils
Soils consisting predominately of, and having its properties determined by, mineral material.

Minimum Viable Population
The low end of the number of individuals of a species needed to ensure the long-term existence of the species.

Mining Claims
A geographic area of the public lands held under the general mining laws in which the right of exclusive possession is vested in the locator of a valuable mineral deposit.

Mitigation
Measures designed to counteract environmental impacts or to make impacts less severe. These may include: avoiding an impact by not taking a certain action or part of an action; minimizing an impact by limiting the degree or magnitude of an action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or compensating for the impact by replacing or providing substitute resources or environments.

Mixed conifer
In Southeast Alaska, mixed conifer stands usually consist of western hemlock, mountain hemlock, Alaska yellowcedar, Western redcedar, and Sitka spruce species. Shorepine may occasionally be present depending on individual sites.

Model
A representation of reality used to describe, analyze, or understand a particular concept. A model may be a relatively simple qualitative description of a system or organization, or a highly abstract set of mathematical equations. A model has limits to its effectiveness, and is used as one of several tools to analyze a problem.

Monitoring
A process of collecting information to evaluate whether or not objectives of a project and its mitigation plan are being realized. Monitoring can occur at different levels: to confirm whether mitigation measures were carried out in the manner called for, to determine whether the mitigation measures were effective, or to validate whether overall goals and objectives were appropriate. Different levels call for different methods of monitoring.

Multi-Entry Layout Process (MELP)
Computerized data base located in each area supervisor's office containing information on timber, transportation, and TLMP management goals. It is used for planning and economic analyses for the Forest Service administrative area.

Multiple-aged Stands
An intermediate form of stand structure between even and uneven-aged stands. These stands generally have two or three distinct tree canopy levels occurring within a single stand.

Multiple Use
The management of all the various renewable resources of the National Forest System to be used in the combination that will best met the needs of the American people.

Muskeg
In Southeast Alaska a type of bog that has developed over thousands of years in depressions or flat areas on gentle to steep slopes. Also called peatlands.

Mycorrhizae
A mutualism between plant roots and certain kinds of fungi. The plants exude carbon compounds to the fungi and the fungi provide the plants with soil nutrients, such as phosphorus.

National Environmental Policy Act (NEPA) of 1969
An Act to declare a national policy which will encourage productive and enjoyable harmony between humankind and the environment, to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of humanity, to enrich the understanding of the ecological systems and natural resources important to the Nation, and to establish a Council on Environmental Quality (The Principal Laws Relating to Forest Service Activities, agric. Handb. 453. USDA Forest Service, 359 p.).

National Forest Management Act (NFMA)
A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act requiring the preparation of Regional Guides and Forest Plans and the preparation of regulations to guide that development.

National Wild and Scenic River System
Rivers with outstanding scenic, recreational, geological, fish and wildlife, historic, cultural, or other similar values designated by Congress under the Wild and Scenic Rivers Act of 1968 and amended in 1986, for preservation of their free-flowing condition. May be classified and administered under one or more of the following categories: Wild, Scenic, and/or Recreational.

Native Allotment
A tract of non-mineral land, not to exceed 160 acres, on which an Alaska Native (who was 21 year of age or head of a household) established continuous use and occupancy prior to the creation of the National Forests (authorized under the Native Allotment Act of May 17, 1906).

Native Selection
Application by Native corporations and individuals to a portion of the USDI Bureau of Land Management for conveyance of lands withdrawn in fullfillment of Native entitlements established under ANSCA.

Net Sawlog Volume
Trees suitable in size and quality for producing logs that can be processed into lumber. In Southeast Alaska, depending on the market, the volume may be processed as pulp or lumber.

No-action Alternative
The most likely condition expected to exist in the future if current management direction were to continue unchanged.

Non-commercial Forest Land
Land with more than 10 percent cover of commercial tree species but not qualifying as Commercial Forest land.

Noncommercial species
Species that have no economic values at this time nor anticipated timber value within the near future.

Nondeclining Even Flow
A policy governing the volume of timber removed from a National Forest, which states that the volume planned for removal in each succeeding decade will equal or exceed that volume planned for removal in the previous decade.

Non-Forest Land
Land that has never supported forests and lands formerly forested but now developed for such nonforest uses as crops, improved pasture, etc.

Notice of Intent (NOI)
A notice printed in the Federal Register announcing that an Environmental Impact Statement will be prepared. The NOI must describe the proposed action and possible alternatives, describe the agency's proposed scoping process, and provide a contact person for further information.

Objectives
The precise steps to be taken and the resources to be used in achieving goals.

Offering
A Forest Service specification of timber harvest units, subdivisions, roads, and other facilities and operations to meet the requirements of a contract.

Offering Area
A geographic area identified by the Forest Service within which the offering specifications are outlined. One or more offering areas may be identified within all or a portion of an a Project Area.

Old Growth
Ecosystems distinguished by old trees and related structural attributes. Old-growth forests are characterized by larger tree size, higher accumulations of large dead woody material, multiple canopy layers, different species composition, and different ecosystem function. The structure and function of an old-growth ecosystem will be influenced by it's stand size and landscape position and context. For the displays in this project, it is those areas typed as volume class 4, 5, 6 and 7.

Organic Soils
Soils that contain a high percentage (generally greater than 20 to 30 percent) of organic matter throughout the soil depth.

Parent Material
The unconsolidated and partially weathered material (or the C Horizon) from which upper layers of soil developed.

Partial Cut
Method of harvesting trees where any number of live stems are left standing in any of various spatial patterns. Not clearcutting. Can include seed tree, shelterwood, or other methods.

Patch
A non-linear surface area differing in appearance from its surroundings.

Payments to States
A fund consisting of approximately 25 percent of the gross annual timber receipts received by the National Forests in that state. This is returned to the State for use on roads and schools.

Peak flow
The highest discharge of water recorded over a specified period of time at a given stream location. Often thought of in terms of spring snowmelt, summer, fall or winter rainy season flows. Also called maximum flow.

pH
The degree of soil acidity or alkalinity.

Planning Area
The area of the National Forest System controlled by a decision document.

Planning Record
A system that records decisions and activities that result from the process of developing a forest plan, revision, or significant amendment.

Plant Association
Climax plant community type.

Plant Communities
Aggregations of living plants having mutual relationships among themselves and to their environment. More than one individual plant community.

Pole
An immature tree between 5 and 9 inches diameter breast height.

Population Viability
Ability of a population to sustain itself.

Potential Yield
The maximum, perpetual, sustained-yield harvest attainable through intensive forestry on regulated areas considering the productivity of the land, conventional logging technology, standard cultural treatments, and interrelationships with other resource uses and the environment.

Present Net Value (PNV)
The difference between the benefits and costs associated with the alternatives.

Prescribed Fire
A wildland fire burning under planned conditions to accomplish specific land and resource objectives. It may result from either a management or natural ignition.

Primary Stream Production
Results from photosynthesis by green plants. In streams, includes production from algae and aquatic plants, and from non-stream sources such as leaf litter.

Primary Succession
Vegetation development is initiated on newly formed soils or upon surfaces exposed for the first time (as by landslides) which have, as consequence, never borne vegetation before.

Process Group
A combination of similar channel types based on major differences in landform, gradient and channel shapes.

Public Participation
Meetings, conferences, seminars, workshops, tours, written comments, responses to survey questionaires, and similar activities designed and held to obtain comments from the public about Forest Service activities.

Receipts
Those priced benefits for which money will actually be paid to the Forest Service: recreation fees, timber harvest, mineral leases, and special use fees.

Record of Decision
A document separate from but associated with an Environmental Impact Statement which states the decision, identifies all alternatives, specifying which were environmentally preferable, and states whether all practicable means to avoid environmental harm from the alternative have been adopted, and if not, why not.

Recreation Opportunity Spectrum (ROS)
Land delineations that identify a variety of recreation experience opportunities categorized into eight classes on a continuum from primitive to urban. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on the extent to which the natural environment has been modified, the type of facilities provided, the degree of outdoor skills needed to enjoy the area and the relative density of recreation use. The eight classes are:
Primitive I: Includes areas out of sight and sound of human activities and greater than 3 miles from roads open to public travel and marine travelways. Provides opportunities for a high-degree of interaction with the natural environment, challenge, risk, and the use of outdoor skills.
Primitive II: Area is similar in appearance to Primitive I ROS class; however, it is accessible by marine travelway or is within 1/4 mile of low-use trails.
Semi-Primitive Nonmtorized: Includes areas greater than 1/4 mile and less than 3 miles from all roads, trials, or readily accessible marine travelways. Provides limited opportunities for isolation from the sights and sounds of humans and a high-degree of interaction with the natural environment. Moderate challenge, risk, and the opportunity to use outdoor skills.
Semi-Primitive Motorized: Includes areas less than 1/4 mile from primitive

roads, trails, or readily accessible marine travelways. Characterized by a predominately unmodified natural environment with minimum evidence of sights and sounds of humans. Road access is not maintained in these areas.
Roaded Natural: Areas are less that 1/4 mile from roads open to public travel, major power lines, and areas of timber harvest. Areas are characterized by predominantly natural environments with moderate evidence of sights and sounds of humans.
Roaded Modified: Areas are less than 1/4 mile from areas of timber harvest and transportation corridors. Areas are characterized by substantially modified natural environments. Sights and sounds of humans are readily evident.
Rural: Includes those areas with small communities, developed campgrounds, and administrative sites. These areas are characterized by substantially modified natural environments. Sights and sounds of humans are readily evident.
Urban: Areas characterized by substantially urbanized environment. The background may have elements of a natural environment. Timber harvest activities and utilization practices are common. Sights and sounds of humans predominant. Large numbers of visitors can be expected on site and in nearby areas.

Reforestation
The natural or artificial restocking of an area with trees.

Regeneration
The process of establishing a new crop of trees on previously harvested land.

Regional Forester
The Forest Service official responsible for administering a single region.

Regional Guide
The guide developed to meet the requirements of the Forest and Rangeland Renewable Resources Planning Act of 1974 as amended. It guides all natural resource management activities and establishes management standards and guidelines for the National Forest System lands within a given region.

Rehabilitation
Actions taken to protect or enhance site productivity, water quality, or other values for a short period of time.

Reserved Lands
Lands reserved from the public domain for National Forest purposes and lands which are added to the National Forest System by exchange for reserved National Forest lands.

Resident fish
Fish that are not anadromous and that reside in freshwater on a permanent basis. Resident fish include non-anadromous dolly varden char and cutthroat trout.

Resource values
The tangible and intangible worth of forest resources.

Responsible Official
The Forest Service employee who has the delegated authority to make a specific decision.

Restricted Harvest
The action of apportioning the supply of a resource to specific uses or to particular persons or organizations.

Restoration
The long-term placement of land back into its natural condition or state of productivity.

Retention Factor
The amount of commercial forest land removed from the calculation of the ASQ as an allowance to protect other resource values. These factor allowances available to draw upon when meeting other resource needs and are not fixed policies to be rigidly applied by the interdisciplinary team or Forest supervisors.

Revegetation
The re-establishment and development of a plant cover. This may take place naturally through the reproductive processes of the existing flora or artificially through the direct action of reforestation or reseeding.

Riparian Area
Geographically delineable area with distinctive resource values and characteristics that contain elements of aquatic and riparian ecosystems.

Riparian Ecosystem
Land next to water where plants that are dependent on a perpetual source of water occur.

Roads
Arterial. Roads usually developed and operated for long-term land and resource management purposes to constant service.
Collector. Collects traffic from Forest local roads; usually connects to a Forest arterial or public highway.
Local. Provides access for a specific resource use activity such as a timber sale or recreational site, although other minor uses may be served.
Preplanned. Roads planned in a prior EIS.
Temporary. For National Forest timber sales, temporary roads are constructed to harvest timber on a one-time basis. These logging raods are not considered part of the permanent Forest transportation network and have stream crossing structures removed, erosion measures put into place, and the road closed to vehicular traffic after harvest is completed.

Roadless area
An area of undeveloped public land within which there are no improved roads maintained for travel by means of motorized vehicles intended for highway use.

Rotation
The planned number of years (approximately 100 years in Alaska) between the time that a Forest stand is regenerated and its next cutting at a specified stage of maturity.

Rotation age
The age of a stand when harvested at the end of a rotation.

RPA Assessment and Program
The RPA Assessment is prepared every ten years and describes the potential of the nation's forests and rangelands to provide a sustained flow of goods and services. The RPA Program is prepared every five years to chart the long-term course of Forest Service management of the National Forests, assistance to State and private landowners, and research. They are prepared in response to Sections 3 and 4 of the Forest and Rangeland Renewable Resources Planning Act of 1974 (RPA) (16 U.S.C. 1601).

Salvage Sale
A timber sale to use dead and down timber and scattered poor-risk trees that would not be marketable if left in the stand until the next scheduled harvest.

Sawlog
That portion of a tree that is suitable in size and quality for the production of dimension lumber collectively known as sawtimber.

Scheduled Lands
Land suitable and scheduled for timber production and which are in the land base for the calculation of the allowable sale quantity and long-term sustained yield timber capacity.

Scheduled Timber Harvests
Timber harvests done as part of meeting the allowable sale quality.

Scoping Process
Early and open activities used to determine the scope and significance of a proposed action, what level of analysis is required, what data is needed, and what level of public participation is appropriate. Scoping focuses on the issues surrounding the proposed action, and the range of actions, alternatives, and impacts to considered in an EA or an EIS.

Scrub-Shrub Wetland
Wetlands dominated by woody vegetation less than 20 feet tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. In Southeast Alaska this includes forested lands where trees are stunted because of poor soil drainage.

Second Growth
Forest growth that has become established following some disturbance such as cutting, serious fire, or insect attack; even-aged stands that will grow back on a site after removal of the previous timber stand.

Secondary Stream Production
Results from consumption by animals of materials produced in primary production in streams; this includes production of macroinvertebrates and some fish species.

Secondary Succession
The process of re-establishing vegetation after normal succession is disrupted by fire, cultivation, lumbering, windthrow, or any similar disturbance.

Sediment
Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, gravity, or ice and has come to rest on the earth's surface.

Seed Tree
Small number of seed-bearing trees left singly or in small groups after timber harvest to provide seed for regeneration of the site.

Selective Cutting
The annual or periodic removal of trees (particularly the mature), individually or in small groups from an uneven-aged forest to achieve the balance among diameter classes needed for sustained yields, and in order to realize the yield, and establish a new crop of irregular constitution. Note: The improvement of the Forest is a primary consideration.

Sensitive Species
Plant and animal species which are susceptible or vulnerable to activity impacts or habitat alterations. Those species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species, that are on a non-official State list, or that are recognized by the regional forester as needing special management to prevent placement on Federal or state lists.

Sensitivity Level
A map inventory that measures peoples' concern for the scenic quality of the National Forests. In 1980, the Tongass National Forest assigned sensitivity levels to land areas viewed from anchorages, plane and boat routes, roads, trails, public-use areas, and recreation cabins.
Level I: Includes all seen areas from primary travel routes, use areas, and water bodies where at least three-fourths of the Forest visitors have a major concern for scenic quality.
Level II: Includes all seen areas from primary travel routes, use areas, and water bodies where at least one-fourth of the Forest visitors have a major concern for scenic quality.
Level III: Includes all seen areas form secondary travel routes, use areas, and water bodies where less than one-fourth of the Forest visitors have a major concern for scenic quality.

Seral
Early stage of succession.

Shelterwood Cutting
A harvest method in which most of the trees are removed in an initial entry and some trees are left to naturally reseed the area and provide protection to new seedlings that establish on the site. A second entry is conducted later to remove the remaining trees.

Silviculture
The science of controlling the establishment, composition, and growth of forests.

Single-tree selection
A cutting method to develop and maintain uneven-aged stands by removal of selected trees from specified age classes over the entire stand area in order to meet a predetermined goal of age distribution and species in the remaining stand.

Site Index
A measure of the relative productive capacity of an area for growing wood. Measurement of site index is based on height of the dominant trees in a stand at a given age.

Site Preparation
Manipulation of the vegetation or soil of an area prior to planting or seeding. The manipulation follows harvest, wildfire, or construction in order to encourage the growth of favored species. Site preparation may include the application of herbicides burning, or cutting of living vegetation that competes with the favored species; tilling the soil; or burning of organic debris (usually logging slash) that makes planting or seeding difficult.

Site Productivity
Production capability of specific areas of land.

Slope Distance
Distance measured along the contour of the ground.

Smolt
Young silvery-colored salmon or trout which move from freshwater streams to saltwater.

Snag
A standing dead tree, usually greater than 5 feet tall and 6 inches in diameter at breast height.

Soil Productivity
The capacity of a soil, in its normal environment, to produce a specific plant or sequence of plants under a specific system of management.

Soil Quality Standards
Standards that are a combination of 1) "threshold" values for severity of soil property alteration, or significant change in soil properties conditions, and 2) areal extend of disturbance.

Soil Resource Inventory (SRI)
An inventory of the soil resource based on landform, vegetative characteristics, soil characteristics, and management potentials.

Special Habitats
Structural elements of ecosystems. These may include, but are not limited to: snags, spawning gravels, fallen trees, aquatic reefs, caves, seeps, and springs.

Special Use Authorization
A permit, term permit, temporary permit, lease, or easement that allows occupancy or use of, or rights and privileges on National Forest System lands.

Special Use Permit
Permits and granting of easements (excluding road permits and highway easements) authorizing the occupancy and use of land.

Specify
"Specify" means to approve an Offering in writing by issuance of an A Division for the Offering, for implementation in conformance with the other requirements of the contract.

Split lines
The process of separating the direction of timber harvest yarding into opposite directions.

Stand (Tree Stand)
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the forest in adjoining areas.

Standard
A course of action or level of attainment required by the forest plan to promote achievement of goals and objectives.

State Historic Preservation Officer (SHPO)
State appointed official who administers Federal and State programs for cultural resources.

State Selection
Application by Alaska Department of Natural Resources to the USDI Bureau of Land Management for conveyance of a portion of the 400,000 acre State entitlement from vacant and unappropriated National Forest System lands in Alaska, under the Alaska Statehood Act of 1959 (Public Law 85-508, 72 Stat. 340).

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard; that is, the basal area or number of trees required to fully use the growth potential of the land.

Stream Classes
See Aquatic Habitat Management Unit.

Stream Order
First order streams are the smallest unbranched tributaries; second order streams are initiated by the point where two first order streams meet; third order streams are initiated by the point where two second order streams meet, and so on.

Structural Diversity
The diversity of forest structure, both vertically and horizontally, which provides for a variety of forest habitats such as logs and multi-layered forest canopy for plants and animals.

Stumpage
The value of timber as it stands uncut in terms of dollar value per thousand board feet.

Subsistence
Section 803 of the Alaska National Interest Lands Conservation Act defines subsistence use as, "the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal or family consumption as food, shelter, fuel, clothing,

tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade."

Subsistence Use Area
Important Subsistence Use Areas include the "most reliable" and "most often hunted" categories from the Tongass Resource use Cooperative Survey (TRUCS) and from subsistence survey data from ADF&G, the University of Alaska, and the Forest Service, Region 10. Important use areas include both intensive and extensive use areas for subsistence harvest of deer, furbearers, and salmon.

Substantive Comment
A comment that provides factual information, professional opinion, or informed judgement germane to the action being proposed.

Substrate
The type of material in the bed (bottom) of rivers and streams.

Succession
The ecological progression of community change over time, characterized by displacements of species leading towards a stable climax community.

Suitable
Commercial Forest land identified as having both the biological capability and availablility to produce industrial wood products.

Suitable Forest land
Forest land for which technology is available that will ensure timber production without irreversible resource damage to soils, productivity, or watershed conditions, and for which there is reasonable assurance that such lands can be adequately restocked, and for which there is management direction that indicated that timber production is an appropriate use of that area.

Suspended Sediment
The very fine soil particles which remain in suspension in water for a considerable period of time without contact with the stream or river channel bottom.

Sustained Yield
The amount of renewable resources that can be produced continuously at a given intensity of management.

Swale
A slight, marshy depression in generally level land. A depression in glacial ground moraine.

Tentatively Suitable Forest Land
Forest land that is producing or is capable of producing crops of industrial wood and: (a) has not been withdrawn by Congress, the Secretary of Agriculture of the Chief of the Forest Service; (b) existing technology and knowledge is available to ensure timber production without irreversible damage to soils productivity, or watershed conditions; (c) existing technology and knowledge, as reflected in current research and experience, provides reasonable assurance that it is possible to restock adequately within 5 years

after final harvest; and (d) adequate information is available to project responses to timber management activities.

Terrestrial Ecosystems
Plant communities that are not dependent on a perpetual source of water to grow

Thinning
The practice of removing some of the trees in a stand so that the remaining trees will grow faster due to reduced competition for nutrients, water, and sunlight. Thinning may also be done to change the characteristics of a stand or wildlife or other purposes. Thinning may be done at two different stages.

Threatened Species
Plant or animal species which is likely to become endangered throughout all or a significant portion of its range within the foreseeable future, as defined in the Endangered Species Act of 1973, and which has been designated in the Federal Register by the Secretary of the Interior as a threatened species. (See also, endangered species, sensitive species.)

Threshold
The point or level of activity beyond which an undesirable set of responses begins to take place within a given resource system.

Tiering
Eliminating repetative discussions of the same issue by incorporating by reference. The general discussion in an environmental impact statement of broader scope; e.g., this document is tiered to the Tongass Land Management Plan, as amended.

Timber Appraisal
Establishing the fair market value of timber by taking the selling value minus manufacturing costs, the cost of getting logs from the stump to the manufacturer, and an allowance for profit and risk.

Timber Classification
Forested land is classified under each of the land management alternatives according to how it relates to be management of the timber resource. The following are definitions of timber classifications used for this purpose.
Nonforest: Land that has never supported forests and land formerly forested where use for timber production is precluded by development or other uses.
Forest: Land at least 10-percent stocked (based on crown cover) by forest trees of any size, or formerly having had such tree cover and not currently developed for nonforest use.
Suitable or suitable available: Land to be managed for timber production on a regulated basis.
Unsuitable: Forest land withdrawn from timber utilization by statute or administrative regulation (for example, wilderness), or identified as inappropriate for timber production in Forest planning process.
Commercial forest: Forest land tentatively suitable for the production of continuous crops of timber and that has not been withdrawn.

Timber Dispersion
When an opening created from a final timber harvest is no longer considered an opening for the purpose of scheduling adjacent timber harvest. This is often expressed as the maximum amount of disturbance in a watershed at any given time.

Timber Harvest Unit
A "Timber Harvest Unit" is a portion of an Offering Area within which Forest Service specifies for harvest all or part of the timber to meet the requirements of this contract and designates as Included Timber under B2.3.

Timber Stand Improvement (TSI)
All noncommercial intermediate cutting and other treatments to improve composition, condition, and volume growth of a timber stand.

Tongass Land Management Plan (TLMP)
The 10-year land allocation plan for the Tongass National Forest that directs and coordinates planning, the daily uses, and the activities carried out within the forest. Currently under revision.

Tongass Resource Use Cooperative Survey (TRUCS)
A study on subsistence uses which was used for evaluating the effects of the proposed action in this EIS.

Turbidity
An indicator of the amount of sediment suspended in water.

Understory
The trees and shrubs in a forest growing under the canopy or overstory.

Uneven-Aged Management
Forest management techniques which simultaneously maintain continuous high-forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes.

Unscheduled Lands
Lands suitable but not scheduled for timber production and which are not in the land base for the calculation of the allowable sale quantity nor long-term sustained yield timber capacity.

Unsuitable
Forest land withdrawn from timber utilization by statute or administrative regulation; for example, wilderness, or identified as not appropriate for timber production in the forest planning process.

Utility Logs
Those logs that do not meet sawlog grade but are suitable for production of firm useable pulp chips.

VAC
See Visual Absorption Capability.

Value Comparison Unit (VCU)
Areas which generally encompass a drainage basin containing one or more large stream systems; boundaries usually follow easily recognizable watershed divides. Established to provide a common set of areas where resource inventories could be conducted and resource interpretations made.

Viable Population
The number of individuals of a species required to ensure the long-term existence of the species in natural, self-sustaining populations adequately distributed throughout their region.

Viewshed
An expansive landscape or panoramic vista seen from a road, marine water way or specific viewpont.

Visual Quality Objectives (VQO)
Measurable standards reflecting five different degrees of landscape alteration based upon a landscape's diversity of natural features and the public's concern for high scenic quality. The five categories of VQOs are:
Preservation: Permits ecological changes only. Applies to wilderness areas and other special classified areas. Management activities are generally not allowed in this setting.
Retention: Provides for management activities that are not visually evident to the casual Forest visitor.
Partial Retention: Management activities remain visually subordinate to the natural landscape.
Modification: Management activities may visually dominate the characteristics landscape. However, activities must borrow from naturally established form-line color and texture so that the visual characteristics resemble natural occurrences within the surrounding area when viewed in the middleground distance.
Maximum Modification: Management activities may dominate the landscape but should appear as a natural occurrence when viewed as background.

V-Notches
A deeply incised valley along some waterways that would look like a "V" from a cross-section. These abrupt changes in terrain features are often used as harvest unit or yarding boundaries.

Volume
Stand volume based on standing net board feet per acre by Scribner Rule.

Volume Class
Used to describe the average volume of timber per acre in thousands of board feet (MBF). The seven volume classes include:
Classes 1 to 3: Less than 8 MBF/acre (cleared land, seedlings, or pole timber stands).
Class 4: 8 to 20 MBF/acre.
Class 5: 20 to 30 MBF/acre.
Class 6: 30 to 50 MBF/acre.
Class 7: 50+ MBF/acre.

Watershed
The area that contributes water to a drainage or stream. Portion of the forest in which all surface water drains to a common point. Watersheds can range from a few tens of acres that drain a single small intermittent stream to many thousands of acres for a stream that drains hundreds of connected intermittent and perennial streams.

Wetland
Areas that are inundated by surface or groundwater frequently enough to support vegetation that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include: swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflows, mudflats, and natural

ponds. See the TLMP Draft Revision pgs. 3-423 and 3-424 for detailed discussion on wetland type definitions.

Wilderness
Areas designated by congressional action under the 1964 Wilderness Act. Wilderness is defined as undeveloped federal land retaining its primeval character and influence without permanent improvements or humans habitation. Wilderness areas are protected and managed to preserve their natural conditions, which generally appear to have been affected primarily by the forces of nature, with the imprint of human activity substantially unnoticeable; have outstanding opportunities for solitude or a primitive and unconfined type of recreation; areas of at least 5,000 acres are of sufficient size to make practical their preservation, enjoyment, and use in an unimpaired condition; and may contain features of scientific, educational, scenic, or historical value as well as ecologic and geologic interest. In Alaska, Wilderness has been designated by ANILCA and TTRA.

Wildlife Analysis Area (WAA)
A division of land used by the Alaska Department of Fish and Game for wildlife analysis.

Wildlife Habitat
The locality where a species may be found and where the essentials for its development and sustained existence are obtained.

Wildlife Habitat Management Unit (WHMU)
An area of wildlife habitat identified during the IDT process as having values important to wildlife.

Windfirm
Trees that have been exposed to the wind throughout their life and have developed a strong root system or trees that are protected from the wind by terrain features/

Windthrow
The act of trees being uprooted by the wind. In Southeast Alaska, Sitka spruce and hemlock trees are shallow rooted and susceptible to windthrow. There generally three types of windthrow - endemic where individual trees are blown over; catastrophic where a major windstorm can destroy hundreds of acres; and management related, where the clearing of trees in an area make the adjacent standing trees vulnerable to windthrow.

Winter Range
An area, usually at lower elevation, used by big game during the winter months; usually smaller and better-defined than summer ranges.

Withdrawal
The withholding of an area of Federal land from settlement, sale, location, or entry under some or all of the general land laws for the purpose of limiting activities under those laws in order to maintain other public values in the area.

Yarding
Hauling timber from the stump to a collection point.

Yield Tables
Tables that estimate the level of outputs that would result from implementing a particular activity. Usually referred to in conjunction with FORPLAN input or output. Yield tables can be developed for timber volumes, range production, soil and water outputs, and other resources.

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